# Concrete

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## That Water-Cement Ratio

We hear every day or so of someone or other trying out the water-cement ratio method of control and finding it of practical value. We believe it, therefore, high time to call the attention of our readers to the situation. For some time, several engineers have been working out the idea, and the final results were reported last winter by the Committee on Building Laws and Specifications to the American Concrete Institute. Since then the idea has been tested on a number of jobs. We are informed that the influence of the amount of mixing water on the strength of concrete far outweighs the influence of differences in aggregates, and that any system of control must keep this in mind as the controlling factor. A table of strengths and water-cement ratios necessary to obtain them has been accurately worked out. By merely referring to the table we now can see how much water per sack of cement is required, subtract the amount already found to be in the aggregates, and add just this amount of water to each batch. No intricate calculations of surface area, fineness modulus, voids, or other things are longer necessary. The problem has advanced beyond that stage, and has resolved itself into a simple operation that gives a reliable uniform run of workable concrete of the required strengths. Adjustments may be made as often as necessary with but little trouble. It is said by many to be the simplest and most reliable system of control yet devised.

## Sell on Merit

D. R. Collins, secretary and treasurer of the Wisconsin Concrete Products Association, passes along many good ideas to his members in his Weekly Letters. This is one of them:

### "Selling Your Stuff"

"Some efficiency experts claim that the individual ranks very low in efficiency tests. It has also been stated that only 3 per cent of the people think. I'm not saying whether or not you are one of these individuals whose efficiency is low or whether you are one of the 97 per cent, but this much I will say and that is that if everyone watches his own product and sells his own stuff upon its own merits, he will be kept busy 100 per cent of the time and he won't know what his neighbor is doing. The story is this: You will be busy enough selling your own material on its merits and let the other fellow sell his."

The manufacturer in other states could well obtain inspiration and value from the letters that "Spec" Collins prepares for his own association.

## You Can't Fight a Friend

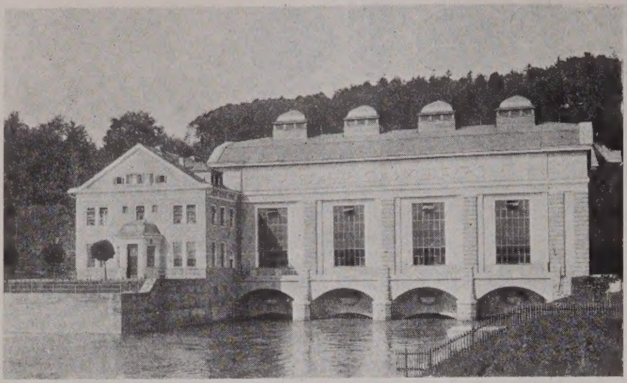
There are two kinds of competition—friendly and otherwise. Two men can compete fairly and remain the best of friends, or can compete the old-fashioned way and never be on speaking terms. If you know your competitor, and have him for a friend, there can be no competition but fair competition. If you do not know your competitor you are tempted to call one another all sorts of names, and end up with the great old cut-throat game of dog-eat-dog, with the bystanders getting the cream of the business. Friendly competition among products manufacturers as in all other lines of business, builds up the business of everyone, leads to lower costs, greater production, bigger and better outlets, and an improved product. It serves the public and serves the manufacturer, and creates good will that has a decided money value. The other sort of competition, on the other hand, leads to cheaper and less reliable products, price cutting, lawsuits, and the distrust of the market. The entire industry can best be served by the type of friendly competition that grows out of the friendships and the co-operation engendered through the activities of the trade association. The structural steel industry has learned this lesson, and so have many others, as was brought out by a speaker at the recent meeting of the Concrete Reinforcing Steel Institute. Parts of our own concrete industry have learned this as well—greatly to their benefit, and that of the industry. There is a splendid idea here for everybody. Better get to work, NOW, and make a real success of the coming convention of your own branch of the industry. You will find money in your pocket as a result.

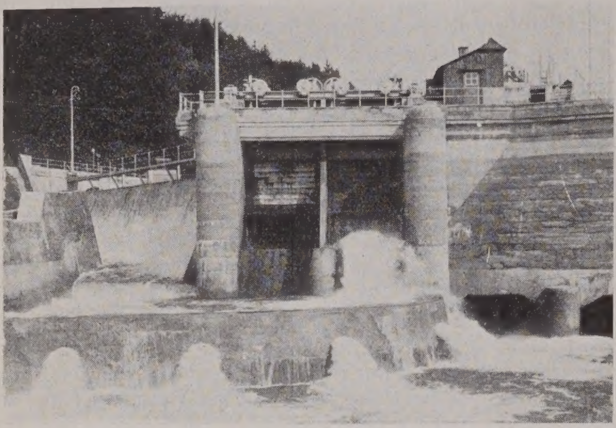
## The Way to Efficiency

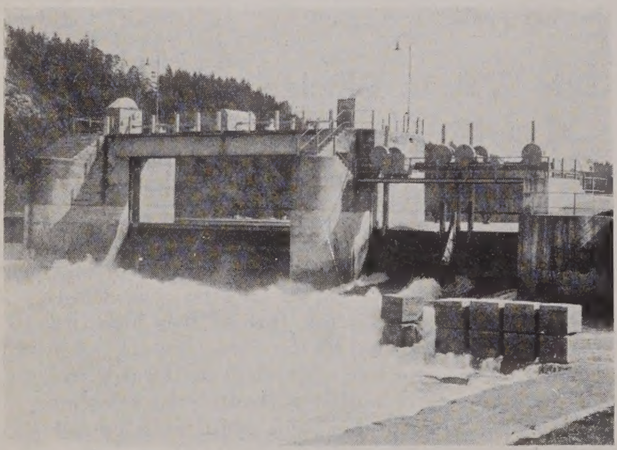
We are slowly recovering from the great reduction in labor efficiency that began with, and followed the war. The average workman is just beginning to give a little more for his hire than he has done for many a year, we are told by several builders. The time seems to be ripe for an application of scientific labor management to hasten this process that is slowly, but surely, being brought about by economic forces. It is high time to talk Quality and Quantity to the men, and to offer inducements that are effective. A system of rewards for unusual skill and for extra output will often work wonders. Certificates of Superior Craftsmanship, as tried out successfully by the New York Building Congress, and a schedule of financial reward for extra output, based on some sort of a piece-work system, are well worth trying. They put every individual on his mettle, reveal the weak spots in the organization, and prevent a great deal of the unrest that is felt where the usual system is in force. A labor leader who is loyal to labor will be glad to co-operate.

## Know Your Costs

Elsewhere in this issue there is an article by Arthur J. Peel, an authority on keeping costs on construction work. He brings out a point that is worth a great deal of thought; that time is the essential factor to consider. The contractor on concrete work will find his estimates in complete accord with his actual costs when he knows just how much work per man can be obtained in a given unit of time, under like conditions. The knowledge of how long it will take a crew to pour a given yardage is worth knowing.







# Concrete As Used in German Hydro-Electric Plant Construction

*In Bavaria the manufacturing interests are giving a great deal of attention to the subject of harnessing the rivers to afford electric power in place of that being endangered by the loss of certain coal resources. Since the structures needed in harnessing the rivers must stand for all time, the builders have chosen concrete as the material of construction.*

*At the top we see Carowerk, the third and largest of three power plants on the Altz River development. This plant generates 25,000 h.p., 15,400 kw. The fall at this point is 38 1/2 meters, with a flow of 60 cubic meters per second.*

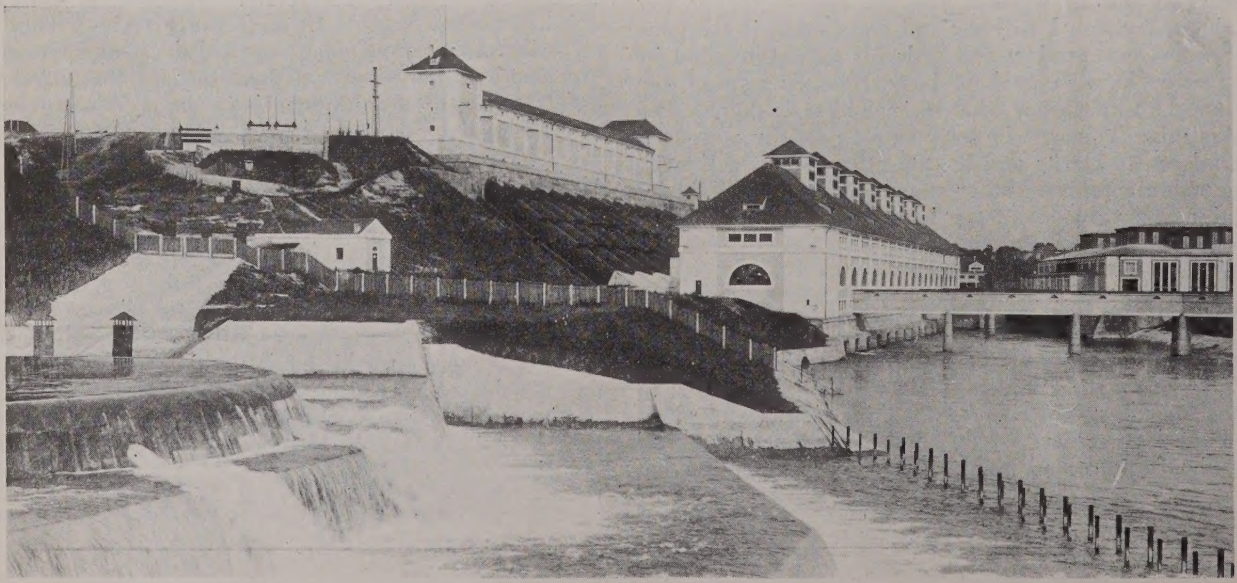
*The next view shows the second diversifying gates on the Altz River development, with the dam and lock. This serves the plant above.*

*The third photograph shows the inlet water gates, overflow gates, and energy breaker at the point where water is diverted from the river and sent to the Carowerk plant to turn the generators.*

*The bottom view is that of the largest water power plant in central Europe. This is Inn Werk, on the Inn River, in Bavaria. It is said to be a model of efficiency. It generates 100,000 h.p. for industrial use. It was put into service quite recently. The water locks building is above, while the iron inlet pipes lead the water to the generator building below.*

*The use of concrete on these and other projects is of importance because of the great quantities involved.*

*(Photographs by Ewing Galloway, New York City)*



# Cork Lined Concrete Houses

## How the Parmeter - Curns Oganization Is Erecting Concrete Dwellings for the Detroit Market, Using Cork for a Lining, at a Cost That Is Quite Low, Competing with Frame

By HARVEY WHIPPLE

While thousands of good houses are being built of concrete masonry units, more and more of them each year, the construction of monolithic houses has lagged, chiefly it seems, because to build monolithic houses has usually entailed a rather large amount of special equipment, not infrequently many tons of it.

A lively market, especially extensive group construction of houses, will, of course, justify many tons of equipment, where the builder may erect his plant and move it across a large plot, building house after house with every opportunity for repeat operations. The house builder doing a few jobs a year has preferred to use lumber or the various masonry units, methods for the most part fairly well standardized and workmen familiar with them, than to purchase the necessary equipment and train a crew to a set of operations most of which would be strange.

In the concrete field the masonry unit has provided the line of least resistance, for the producer of cement and the builder selling his services. So for the most part there has been little selling effort for the monolithic house and the public, not being conversant with its special advantages, has not clamored for dwellings of that type.

### Cork Board Serves as Inside Form

This prevalent situation gives a contrasting background or the work of Lyle Parmeter, builder, and R. C. Curns, eal estate operator, in the Strathmore section of Detroit, where three concrete houses are being completed in whose construction there are several unusual features, from the viewpoint of both builder and buyer.

*This house, 20x26 ft. in plan, has cork lined concrete walls. It contains five rooms and bath, on a 40x100-ft. lot in the Strathmore section of Detroit. It is the first of the two Sussex Avenue houses to be finished, and sold for $6,500*

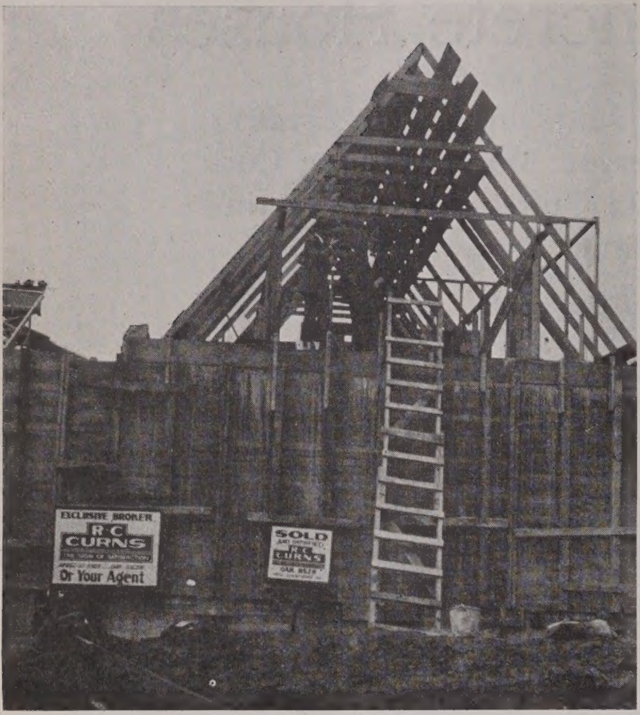
First—With scanty and uncertain coal piles the public has begun to learn something about insulation. The house-dweller has learned most from the lack of it, particularly in trying to heat some of the delicately framed structures which have been the penalty of too much striving for cheapness in the period since the war. He has come to have a deep respect for cork as a means of preventing the passage of heat. Refrigerator builders have shown him sawed-out cross-sections which have made it clear how the heat is kept out of the ice chest.

*The second Sussex Avenue concrete and cork house, 20x32 ft. in plan, on a 40x100-ft. lot, with seven rooms and bath. It sold for $8,000*

So an outstanding thing about the Parmeter-Curns houses from the buyer standpoint is that they are lined, walls and ceilings, with cork—Armstrong cork board in one-inch layers for the walls and one and a half inch layers for the ceilings.

### Cork Acts as Form

The important thing about these houses from the builder standpoint is that the cork, in sheets 12 by 36 inches is now being used for the inside wall form. This saves material and labor for forms and material and labor in installing the insulating material which has usually been done after the concrete was hard and the forms removed. Lining concrete houses with granulated cork which has been pressed into sheets of convenient size is not, of course, new. Hueber Brothers, builders, Syracuse, N. Y., have been doing it for several years and their work has



*By Parmeter's method no part of the job has to wait very long for the concrete. The interior framework, joists, partitions, and even the roof, going up before the concrete is more than started above the foundation. The joists are carried on the falsework until the concrete gets up to them. Here they are ready to roof the job in and the forms aren't stripped on the first story walls, nor the forms erected for the gable ends*

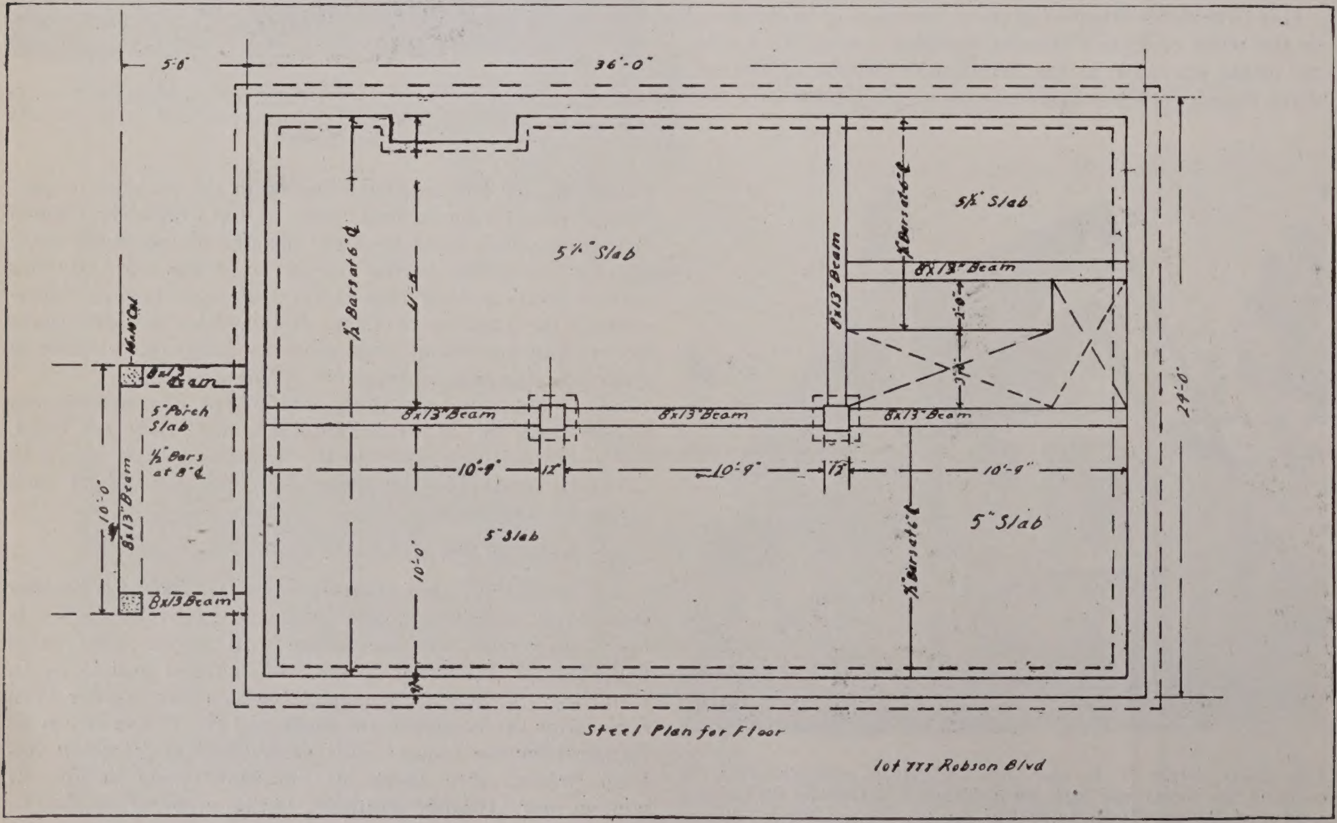
been referred to several times in this magazine. The way in which the cork is used by Hueber Brothers differs radically, however, from the method worked out by Mr. Parmeter and the Parmeter method has gone through two stages of development. The Hueber system of forms was developed for concrete walls and floors. A job is poured a story at a time, the forms stripped and the cork nailed to the concrete, in which cinder aggregate was used for nailability. The cork, with no necessity for furring strips, then became the base for the interior plaster. Parmeter here saves a complete set of operations, by using the cork for his inside form, supported by studs on 10-inch centers.

### Good Bond of Concrete to Cork

The house-builder may be unfamiliar with the bond of plaster and concrete to cork board. Cork board has been used for years in refrigeration work where it has served as a base for cement plaster. Tests made for the producers of the Armstrong board show the pull necessary to separate two 6-inch squares of cork board bonded with gypsum plaster and with cement plaster. With a gypsum plaster of a 1 to 2 mix with sand by weight the average pull necessary to break the bond was 212 lbs. and a mix in the same proportions of cement and sand gave a bond strength of 297 lbs. The granules of cork, of which the board are made, are baked under pressure and cemented by the natural gum of the cork without admixture of other binders.

The second outstanding thing about the Parmeter-Curns houses is the price at which they are being sold—a price that competes with good frame construction, cheaper than brick veneer and considerably cheaper than solid masonry. For an extra 3½ or 4 per cent, or less, on say, a $9000 job, the owner may have a fireproof floor, in the first story, covered with oak in the living rooms and linoleum in the kitchen.

The answer is probably in the fact that Parmeter has been working and building with concrete for years. He stays on and runs the job himself with four men. He



*Basement and first floor plans of the Robson Boulevard bungalow, first of the Parmeter-Curns houses to employ cork board* has no patents, special equipment or processes to sell. So the reader may dismiss the thought of undue bias in what Parmeter reports about his own work. He has nothing to sell but the houses he is building and the three so far built by these methods have been sold before they were completed.

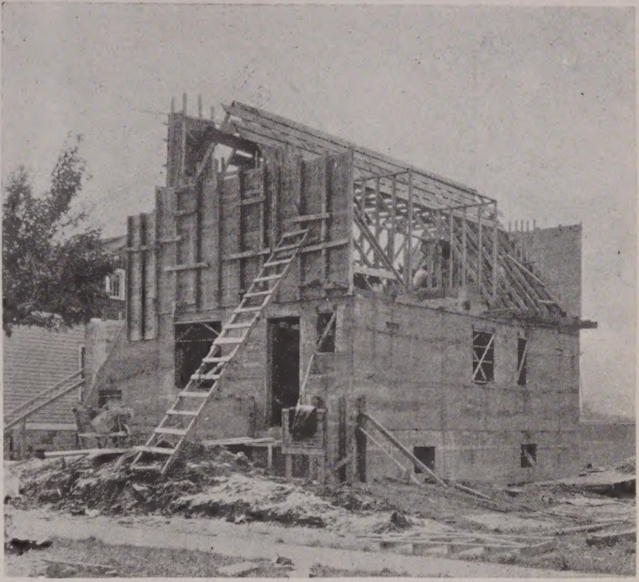
## First Houses Had Double Walls

Parmeter's early experience was with double wall construction and he built several houses by that method. It was only natural that in the first of the group of three houses built so far in the recent work in Strathmore he should build with a double wall, the center space, instead of being hollow, having a 1½-inch sheet cork filler, the sheets being set in as the walls were poured. There was a good deal of grief to the job while the walls were being poured, in getting the cork sheets properly in place. The Detroit Building Department checked up on this job and finding the quality of the concrete good, allowed Parmeter a special dispensation of thinner wall sections on subsequent work. His later houses have 8-inch basement walls, 6-inch first story walls and a 5-inch thickness of concrete in the gables.

The first house built on Robson boulevard is a bungalow, 24 by 36 ft. in plan; basement walls 9½ inches with reinforced concrete slab for the first floor, supported on three 8 by 13 inch concrete beams and two center 12 by 12 inch columns, so spaced that each of the three beams has a length between supports of 10 feet 9 inches, with two additional beams of like section to form the stair well. The house is thus divided through its length with a slab span on one side of ten feet between supports and on the other side 11 feet 8 inches, the shorter span having a 5-inch slab and the longer one a 5½-inch slab, each being reinforced with ½-inch bars 6 inches on centers.

## Fireproof, Oak-Finished Floor

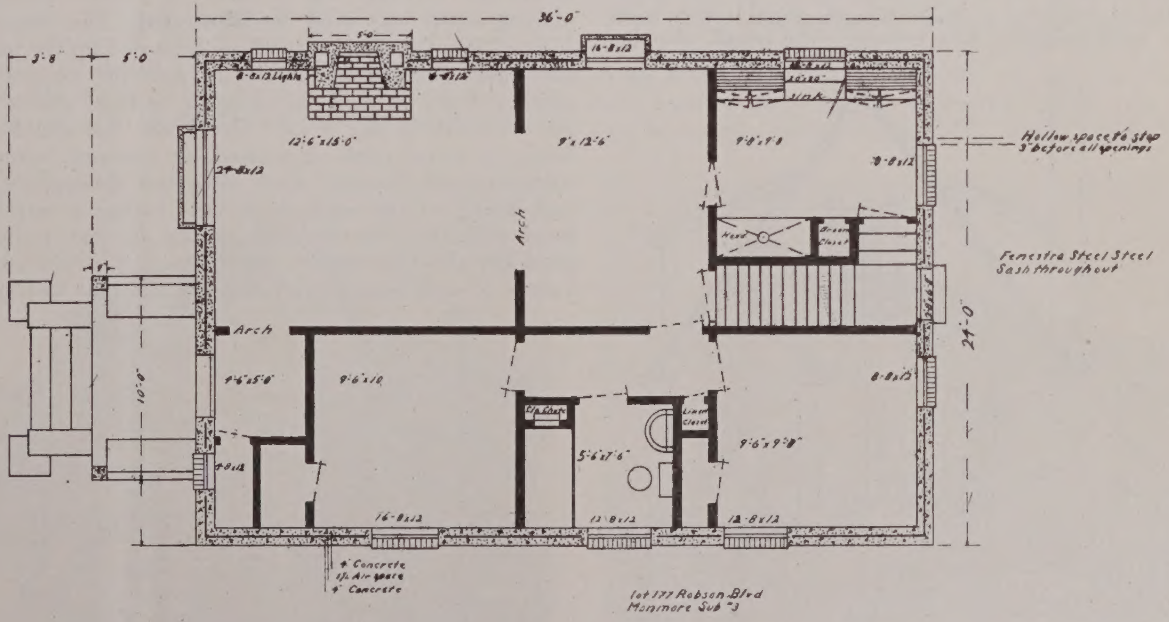
This construction, with finished oak floors over sleepers in the living, dining and bed rooms, tile in bath and linoleum over the concrete slab in the kitchen cost between $250 and $300 more than wood joist and double wood floors.



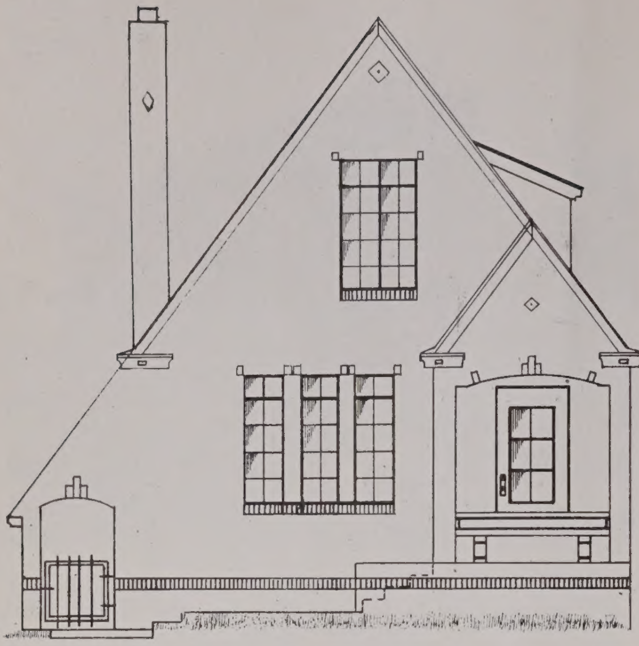
*Here the forms are up for the gable end walls to most of their height, and the roof is being sheathed in. One of the Sussex Avenue houses*

Parmeter quotes the following unit figures as representing the differences in three types of house floor construction. For smooth troweled concrete as a finished surface, stained and waxed, 45 cents per square foot as against 35 cents for wood joist and double wood with oak finish and as compared with 62 cents per square foot for concrete slab, sleepers and oak top.

The wealthy house buyer is frequently glad to pay for the luxury and security of masonry floors, decorated with tile or paved with tile or slate, but the small house buyer, offered the same in security and freedom from repair and



*insulation. In this house, however, it was used as a filler between the two parts of a double concrete wall*

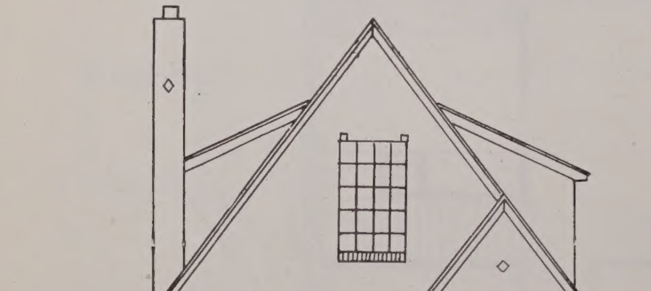


Lot No 669 Sussex Ave.
R. C. Curns
Detroit.

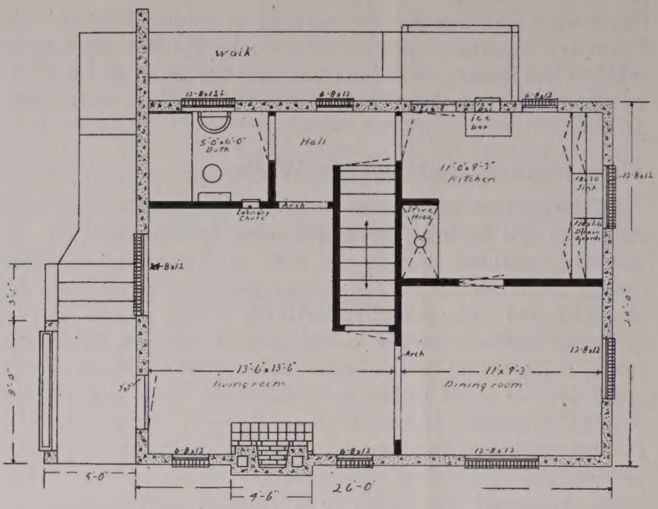
only a trifle less in luxury of finished effect, usually feels that something cheap and unhomelike is being palmed off on him and will have none of it. Thus the 45-cent fireproof floor is not readily marketable in the small house whose buyer is also unable to see how he is going to get his money's worth in satisfaction and security out of an additional outlay of $250 to $300 for the fireproof slab with an oak finish.

### Competes in Price

The Robson boulevard bungalow, on a $1,500 lot, 35 by 90 feet, sold for $8,750 cash as compared with $9,500 for a frame bungalow across the street. The concrete house has Fenestra steel casements throughout, a well-equipped and finished kitchen, a minimum of wood trim—what there is, well finished. The exterior—the porch also being of concrete—is finished in a tinted stucco, and a mottled roof of stained wood shingles—a bungalow that compares favorably in appearance with anything in the neighborhood which is being built up to small homes.



Lot No 702 Sussex Ave.
R. C. Curns
Detroit



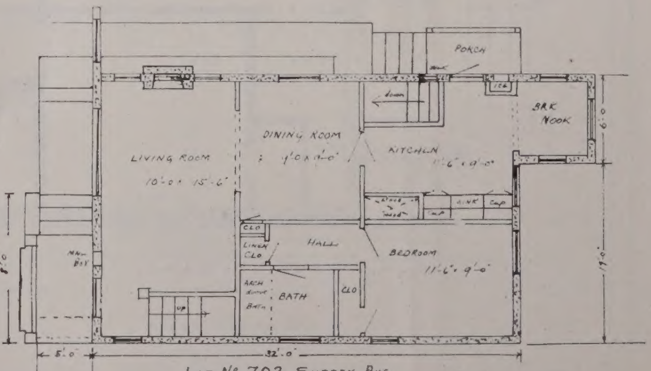
Lot No 669 Sussex Ave.
R C Curns. Detroit.

This job was more or less experimental. It was done before it occurred to Mr. Parmeter that putting the cork in the middle of the wall was waste effort; that by putting the concrete all in one section the building department would sanction less material.

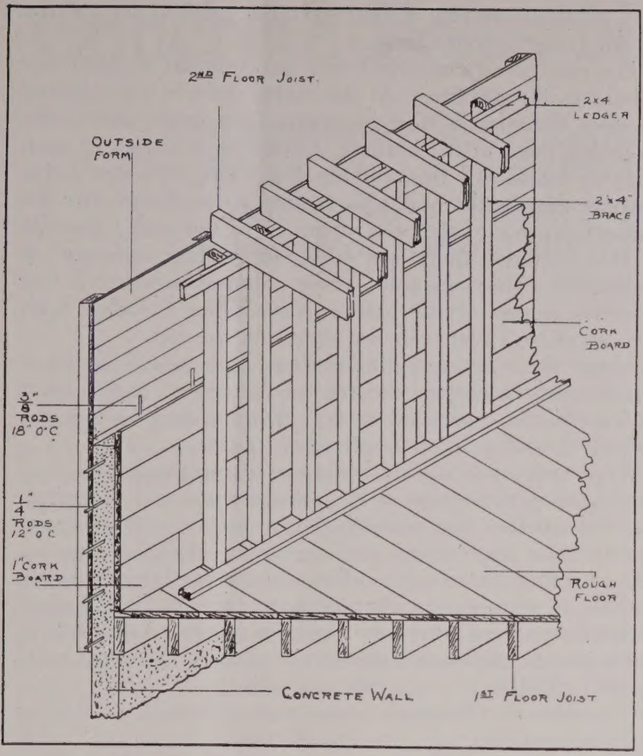
Two houses were then started on Sussex avenue, facing each other from opposite sides of the street.

### Cork Used for Lining

The first to be started, on lot 669, 40 by 100 feet, is 20 by 26 feet in plan with living room, dining room and kitchen on the lower floor and two bed rooms and bath on the upper floor. It is now finished and has been sold at a profit for $6,500. On this job wood form panels were used inside and outside as before, with low form sections on the inside and the cork tacked against the inside forms with 6d finishing nails, driven only part way before the concrete was poured. A Jaeger mixing and placing outfit was used, as illustrated. The concrete is dumped into the small cart which is hauled up the inclined track and dumped automatically into the hopper from which it flows through the swinging delivery chute, reaching the forms at any point. This house has double wood floors on wood joists supported by concrete beams and columns, and Fenestra steel casements throughout. The cork lining of the walls apparently makes a very strong bond with the concrete cast against it, and provides a good key and true surface for the plaster. Only once has a piece of cork board stripped away and that was but one



Lot No 702 Sussex Ave
R C Curns
Detroit.



*Isometric sketch showing the chief features of Mr. Parmeter's house building methods*

piece which was loosened by careless stripping of concrete only two hours old. The 1½-inch cork sheets nailed on the ceiling under the attic come with grooves to add strength to the key of the plaster.

The third job in the series, the one on lot 702, Sussex, also 40 by 100 feet, is a larger dwelling, 20 by 32 feet in plan, with living room, dining room, kitchen, breakfast nook (built on), bed room and bath room downstairs and two bedrooms and generous center hall space upstairs. The buyer plans to utilize this upper hall space to put in necessary plumbing facilities for a two-room light-housekeeping apartment, making his property that increasingly popular type of small house investment known as an "income bungalow." The selling price of this house, finished better in almost every respect than most houses at like cost, was $8000. Close by a five-room frame bungalow, comparable as to floor space with the smaller of the two Sussex avenue concrete houses, sold for $9000, while a five-room brick veneer bungalow sold for $10,000 and a similar house with a sun room added, sold for $12,000.

*The Jaeger mixer and placing equipment used on the Parmeter-Curns house jobs*

Each of the two concrete houses has 8-inch basement walls, 6-inch first story and 4-inch gables of concrete, lined above the basement with 1 inch of cork and with 1½ inches of cork as a base for the plaster of the second story ceiling. Each job required about 45 yards of concrete. Porch posts, beams and flower boxes are of precast concrete, set in place and stuccoed with the rest of the job. The belt course of brick, the brick sills and ornaments were set into recesses, made when the job was poured. Similar ornamentation will hereafter be secured with tile set flush as the forms are placed.

It was on the third of these house jobs that Mr. Parmeter worked out the construction details which he believes will represent his standard procedure in future work. A much larger house is scheduled for early construction.

### How the Job Is Done

The excavation made, Mr. Parmeter goes onto the job with four men, a Jaeger mixer and placing outfit and wooden form panels of the usual type—matched lumber nailed onto two-by-fours. The footing is poured with ⅝-inch steel dowels set two feet on centers throughout the center line of the footing. The outside form panels are then set up with spreader pieces between forms and dowels and the forms wired to the dowels. The outside forms in place and properly braced, similar inside forms are set on the inner edge of the footing and also wired to the dowels. As soon as this stage of the operations has been reached and placing of concrete begins (the necessary basement columns having been poured) joists for the

*One of the Sussex Avenue houses almost ready for the stucco and the brick and tile inserts*

*First of the Parmeter-Curns cork insulated concrete dwellings—The Robson Boulevard bungalow. Notice the concrete flower boxes, the concrete cornice, and the concrete roof gutter* first floor can be thrown across, supported on a ledger spiked to the inside form studs. See the accompanying isometric sketch of the construction. The joists, fire-cut and tarred, are placed to extend into the concrete and form their own pockets, avoiding delay in getting the work under roof and eliminating what Parmeter regards as an unnecessary extra operation. Second floor joists in turn, if they may prove useful in extending through the wall, rest on the outside forms and the end serve as a base for cornice, false roof or gutters depending on the architecture.

### Carpenters Ahead of Concreting

Before the concrete is up to the first floor level carpenters are placing the partitions on the rough floor. By the day following the pouring of the basement walls interior studs are set up 10 inches on centers as a support for the cork board forms and for the second floor joists. Exterior forms are removed from below and reset at the first floor level, hung to the wall already cast by wires to a new set of dowels placed at this level in the concrete. Again see the sketch.

Wall height is economized in the basement by running the wood joists three inches into the main center concrete beams. Bottom forms for these beams are set and the floor joists supported on them. Each joist has a hole in it through which a reinforcing rod is strung to anchor the joists into the beam. To compensate for thus cutting into the beam section the beams are made 6 inches wider than proper design calls for. Beam side forms are made of short boards set in line between the joist ends. This method saves 10 inches in the necessary basement depth or obviates low beams under which one must crouch, and gives a neat workmanlike appearance to the basement ceiling.

As already mentioned, there is a minimum of wood trim in these houses. The windows have a wood sill inside the steel casements and a very necessary 2½-inch strip against which interior screens are placed, the remainder of the wall thickness being rounded back and papered with the rest of the wall, giving a neat appearance without any wood casings.

The Parmeter-Curns work, to which sign-boards with red arrows point the way, is attracting the attention of building interests in several quarters and it is probable that similar construction in larger houses will soon be seen elsewhere in Detroit.

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# Water Tower Has Served 20 Years

This tower was built in 1904 as a part of the new water works of the City of Bordentown, N. J. There being no ground sufficiently elevated about the town to give a proper service pressure from an ordinary reservoir, it became necessary to build this tower and tank. The total height to the top of the tank is 140 feet, the tank proper being 30 feet in diameter and 40 feet high, holding 200,000 gallons of water. The cost of the tower and tank was $10,552.

It should be stated in connection with the costs given that at the present time the works could not be built for less than 2¼ times what they actually cost.

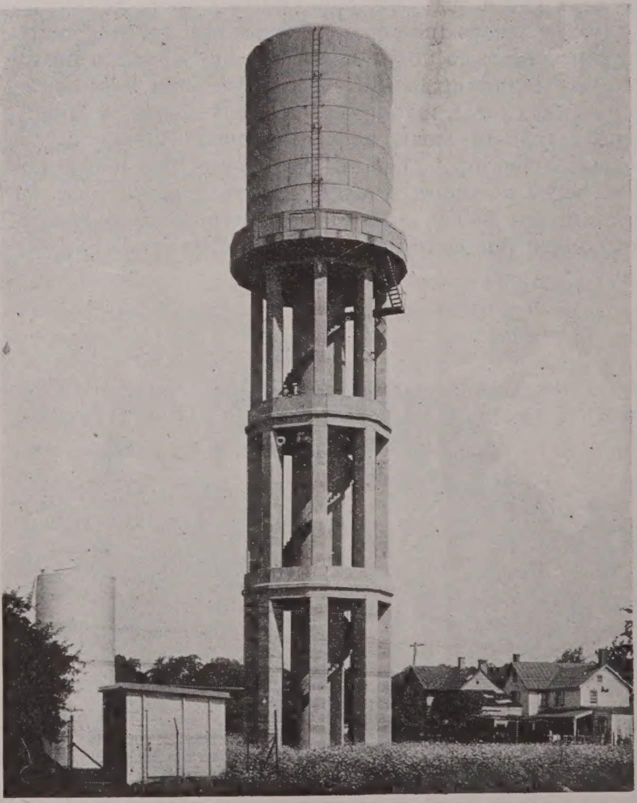
The tower rests on a sub-soil of sand and gravel, and in order to support it properly, a platform of concrete, 40 feet in diameter and 8 feet thick was first laid. The total weight of the tower and tank, including water, is about 2,400 tons. The weight of the water itself when the tank is full being 835 tons. Because of this weight it was necessary to distribute the weight over the sub-soil by the use of this large concrete base.

The reinforced concrete tower is octagonal in plan and is built in three stories. At the center there is a reinforced concrete cylinder 11 feet in external diameter, with walls 18 inches thick at the bottom, decreasing 6 inches in each story to 12 inches thick at the top. This cylinder helps support the weight and also makes an enclosure for the vertical pipes carrying the water up to the tank. Outside of this cylinder there are eight supporting columns at the angles of the octagon. These columns measure 3 feet 6 inches square at the bottom, decreasing 6 inches with each story to 2 feet 6 inches square at the top.

About the interior cylinder there is a spiral stairway giving ready access to the top of the tower, and around the base of the tank there is a platform with a balustrade, making it useful as an observation tower.

When this tower was built the use of reinforced concrete was not as prevalent as at the present time, and its design and construction was somewhat of a novelty, attracting attention from engineering periodicals all over the country. The advantage in using reinforced concrete for this tower consists in eliminating the necessity for painting a steel skeleton structure every two years, in increased durability, and a greatly improved appearance without increased cost. Hugh J. Reilly, Jr., was the contractor.

Cornelius C. Vermeule, engineer in charge of design and construction, designed and built about the same time one of the earliest concrete reservoirs for the city of East Orange, N. J. This was of 5,000,000 gallon capacity and was novel in its construction, but has done good service and is still in excellent condition. He also two or three years later designed and constructed a similar reinforced concrete reservoir for the city of Cienfuegos, Cuba, this being of 10,000,000 gallons capacity. Both of these reservoirs are covered with a reinforced concrete cover, over which is 2 feet of earth, all of which is intended to keep the water cool and in good condition for use.



*This is how the twenty year old concrete water tower looks today*
*Photo by Ewing Galloway, New York*

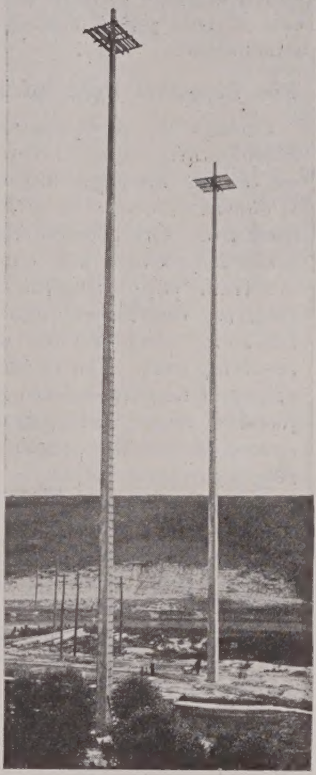
# Concrete Poles Now Widely Utilized

## Accepted by Many, Concrete Poles Extensively Replace Wood, After a Long Period of Experiment and Development — Early Developments and Investigations—The Growth of the Industry—Some Unusual Poles and How They Are Made

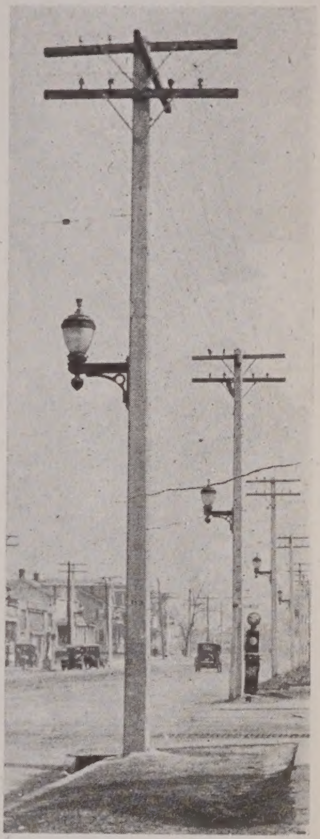
Although research and test are not yet done, we are finding that railroads, utilities, and communities are beginning to recognize the fact that concrete line poles, trolley poles, lighting standards, and poles for other uses can be used with great economy.

Reinforced concrete poles, when properly made, have been found to have certain advantages. They last indefinitely, have more than ample strength, require no painting to guard them against rot or oxidization, will remain in place even though shattered as a result of collision, are not damaged from shorted circuits and lightning, and can be made to present a very pleasing appearance. Their elasticity provides for a yielding under stress within the limits of their strength without inviting failure, since all tension is taken by the reinforcing steel. Materials available everywhere permit their manufacture, with a minimum expense for transportation, plant, and labor. A wide range of shapes, color, and texture are available.

Just as with any other concrete units, problems of design and manufacture are of importance, and must be successfully met before a satisfactory pole can be obtained. Not only must stability of installation be provided, and strength to resist all stresses be afforded, but reinforcing must be so placed that it will be in position to function properly and be protected against corrosion. Rusting steel will cause spalling of concrete, and this means that a dense mass of concrete of sufficient thickness must cover all reinforcement. Economy of manufacture, ease of erection, facility of wiring, climbability, and other factors must be allowed for. These, and other problems, have been practically solved after many years of trial, and a number of different successful designs to meet various conditions have been evolved.



*The two extremely tall poles that were built to carry the power line over the Welland Canal, as told in the article. They are still standing, but not in use*



*Concrete trolley poles of the Virginia Railway and Power Co., Portsmouth, Va.*

### First Poles in Panama

The earliest concrete poles in America, we are informed, were designed and erected on the Isthmus of Panama by Col. G. M. Totten, chief engineer of the Panama Railroad Company, about 1856. This material was used because insects were rapidly destroying the wooden poles usually used. These concrete poles were about twelve feet long, circular in section, having a six to eight-inch top and twelve to fifteen-inch base. The wires were carried on iron bracket crossarms fastened to the tops of the poles by wrought-iron bands. Data on the proportions of the concrete are not now available. By 1888 there were only about twenty of the original poles left standing.*

By 1900, it became quite a practice to cast a concrete base around the decayed butts of wooden poles, thus giving them a new lease on life at a low cost.

### The Hennebique Concrete Pole

In Europe, reinforced concrete poles were probably first devised by M. Hennebique, who is usually credited with being the originator of this type of pole. His trolley poles built in 1896 for the Le Mans Tramway Company, in France, are in use today. These poles are solid, circular in shape, and reinforced with small round rods and transverse wires. A Hennebique pole, tested in 1900, gave a maximum deformation of 28.30 inches and a permanent deformation of only 2.75 inches when the load, applied 27.7 feet above the ground, reached the force of 4012 pounds. Rupture occurred at 4410 pounds. This pole had a top diameter of 6.3 inches, a bottom diameter of 13.8 inches, a total length of 35 feet, and a length above ground of 29.5 feet. Other designs were tried with equal success. A wood pole encased in concrete, reinforced with a spiral, was tried but found to be only temporary. As in the Panama experiment, the wood swelled and rotted and split the concrete shell.

A process invented by the German firm of Otto & Schlosser, at Meissen, on the Elbe, consisted of manufacturing reinforced concrete poles in revolving forms by centrifugal force. To a wet mixture of rich concrete was

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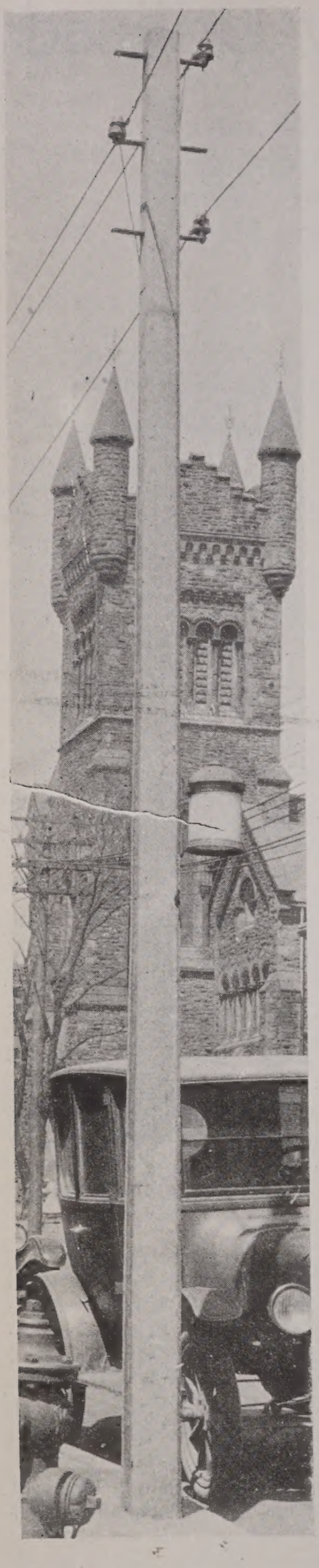
*From Bulletin 25, Association of American Portland Cement Manufacturers, Philadelphia, 1910.



A concrete distribution pole used by the Toronto Hydro Electric Commission, Toronto, Ont. Over 40,000 of these poles are now in use by that concern—some since 1909

added finely ground asbestos fibre, and the resulting mixture placed in a tubular form, inside which the reinforcement of expanded metal had been fastened, and this form revolved at high speed. It was claimed that the centrifugal force compacted the concrete in an even layer against the reinforcement. In erection, these hollow poles had the butts filled with stones to the ground line.

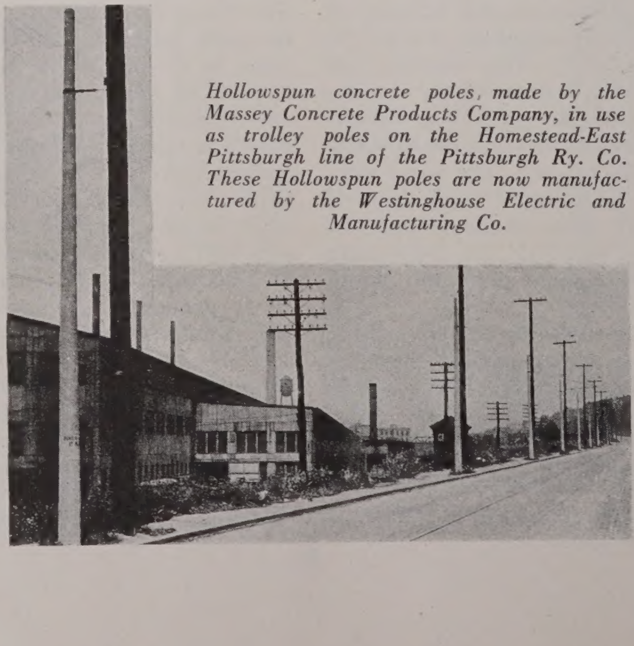
Another type of pole was designed by the Brescia Construction Company, Brescia, Italy. This pole, triangular in section, with concave sides, made in lengths of 26 to 33 feet, was produced in wooden forms, and tapered. A large iron bar in each of the three corners, firmly cross-tied, comprised the reinforcement. These poles, which are said to have been made cheaper than the same sort of iron poles, were unclimbable except with special attachments.

## The Siegwart Pole Successful

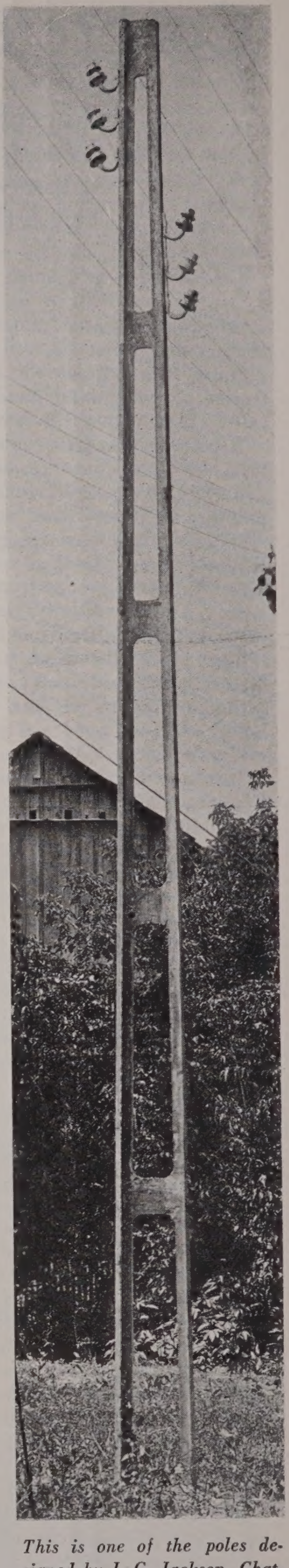
Perhaps the most remarkable process of foreign pole manufacture, we are informed, known as the Swiss Process, is that invented and controlled by Messrs. Siegwart. It consists essentially of a horizontal, collapsible core of sheet iron, with pivoted ends, carried by a movable frame which is provided with trucks. Below this revolving core is a frame supporting the continuous conveyor belt, which receives, distributes, and applies the concrete to the fabricated steel skeleton which has been fastened in the revolving core. The reinforcement consists of small rods, arranged lengthwise, and held accurately in place by adjustable rings with grooves to keep the steel evenly spaced and at the proper distance from the interior and exterior concrete surfaces. On the under frame is mounted an electric motor which operates the moving parts by means of belts and worm gearing. The concrete is of a dry consistency of Portland cement, sand, and screenings, and as rapidly as applied is bound fast by canvas, wound around and smoothed out by pressing rollers which take up the slack in the canvas binding by a special contrivance. When the core has traveled the full length of the pole, it is entirely covered with concrete and canvas. The pole is allowed to cure in a horizontal position, from ten to fifteen hours, after which the steel core is collapsed and withdrawn. In about seven days the canvas can be removed and the pole prepared for use. A large number of these poles have been used, and have been said to have made good under difficult conditions.

## Early American Developments

The development of concrete poles in this country has



*Hollowspun concrete poles, made by the Massey Concrete Products Company, in use as trolley poles on the Homestead-East Pittsburgh line of the Pittsburgh Ry. Co. These Hollowspun poles are now manufactured by the Westinghouse Electric and Manufacturing Co.*



*This is one of the poles designed by J. G. Jackson, Chatham, Ontario. This type of pole has attracted a great deal of attention* been surprising. It has paralleled that of Europe to a great extent, and in recent years has been concerned more with refinement of design and improvement of manufacturing methods than with the development of entirely new principles.

Early in 1904 the United Traction Company of Albany, New York, began a series of experiments on reinforced concrete poles by first testing a model pole.

So favorable were the results of this test, a pole suitable to electric railway use was then made. This pole, which was 34 feet long, and designed to be buried six feet was tapered from 13x13 inches at the base to 8x8 inches at the top. The reinforcement was composed of ten ½-inch and two ¾-inch square, cold twisted, steel bars, eight of which were arranged in a circle and enclosed in a spiral of ¼-inch twisted steel with a 6-inch pitch. Two ¾-inch and two ½-inch rods were symmetrically placed in the corners outside the circle and extended the full length of the pole; the remaining rods terminated in groups at the one-half and three-quarter points. This pole was designed for a pull of 1000 pounds applied 20 feet from the ground, but was not subjected to any considerable loading. This is reputed to have been the first actual reinforced concrete pole manufactured for electric traction use in the United States.

In 1904, two reinforced concrete poles were designed and built by the Schenectady Railway Company, Schenectady, New York. These poles were essentially the same as the one manufactured by the preceding concern, except that they were tapered more, had reinforcing of a different gauge, and were made of 1:1½:3½ concrete. In handling, these poles proved quite cumbersome, and several cracks appeared during erection. The reinforcing was apparently not adequate to care for erection strains. They proved sufficiently well designed for the required use, however, since they functioned without further sign of trouble for some years.

In November, 1905, Wallace Marshall, Lafayette, Ind., made and tested one pole in comparison with a wooden pole. When a deflection of about 21 inches was obtained, a series of cracks was observed in the concrete, and the load was then removed. The pole immediately returned to its original position. The stress in the reinforcement was found to have been about equal to the elastic limit of the steel.

### Poles Found Amply Strong

In 1905, R. E. Cummings, Pittsburgh, Pa., tested two concrete poles in comparison to two cedar poles, under extreme conditions represented by a maximum ice coating on a line of 50 wires. While the cedar poles were completely fractured, the concrete poles failed without coming out of service. In fact, after this failure, the reinforcing so held them in place that a pull almost equal to the breaking pressure was required to further deflect them from their slightly inclined position.

(To be concluded next month)

*One of the Syracuse poles built in 1914 and still in perfect condition*

*Here are some of the 202 poles built across the Hackensack Meadows, Jersey City, N. J., by the Pennsylvania Railroad in 1910. This pole line, though heavily loaded, has rendered distinguished service*

*This pole was placed in service in Watervliet, N. Y., in 1904, and is still in service. Built by United Traction Co., Albany, N. Y.*

*Combination heaters and salamanders like this will frequently pinch hit for an overworked boiler room on the worst days. A water coil around the fire heats the water while the fire heats the room.*

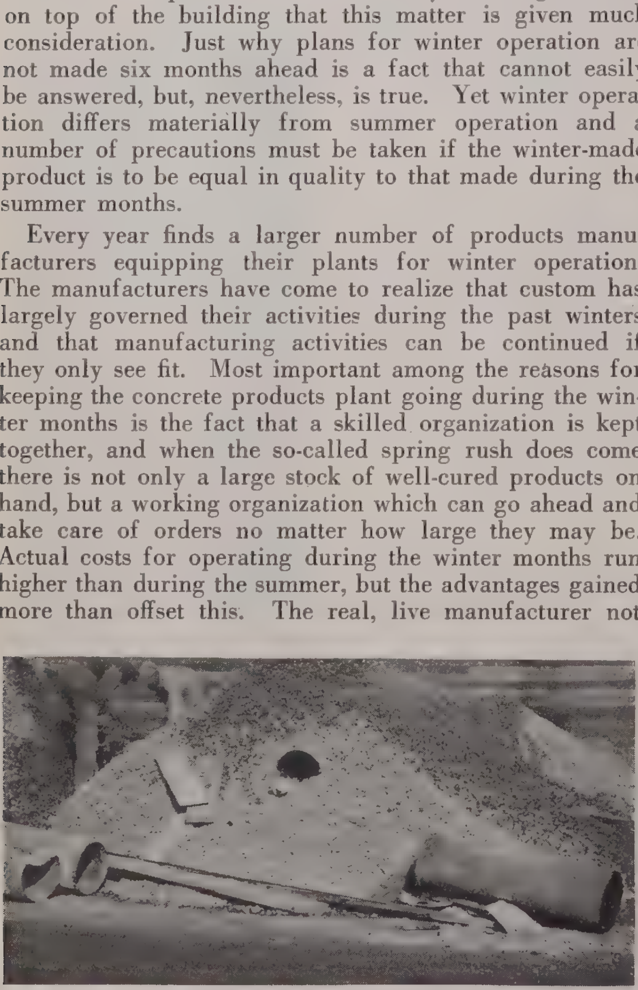
# Operating the Plant in Winter

## The Products Manufacturer Can Profit by Winter Operations—Methods That Make Cold Weather Operation Possible—Turn That Winter Overhead into Profit

By D. R. COLLINS
Secretary-Treasurer Wisconsin Concrete Products Association, Milwaukee, Wis.

When the perspiration is cascading from the brow of the average concrete products manufacturer and the sun threatening to drive the mercury through the top of the thermometer, he thinks little of getting his plant in shape for winter operation. It is the first morning that he arrives at his plant and finds a heavy covering of frost on top of the building that this matter is given much consideration. Just why plans for winter operation are not made six months ahead is a fact that cannot easily be answered, but, nevertheless, is true. Yet winter operation differs materially from summer operation and a number of precautions must be taken if the winter-made product is to be equal in quality to that made during the summer months.

Every year finds a larger number of products manufacturers equipping their plants for winter operation. The manufacturers have come to realize that custom has largely governed their activities during the past winters and that manufacturing activities can be continued if they only see fit. Most important among the reasons for keeping the concrete products plant going during the winter months is the fact that a skilled organization is kept together, and when the so-called spring rush does come there is not only a large stock of well-cured products on hand, but a working organization which can go ahead and take care of orders no matter how large they may be. Actual costs for operating during the winter months run higher than during the summer, but the advantages gained more than offset this. The real, live manufacturer not only keeps up his activities in the plant during the winter, but those outside as well. Through these activities he has built up quite a winter business.



*One way to thaw frozen sand is to pile it over a length of culvert or other cylinder and start a fire in the tube*

*An oil burner is used by some men to keep the material hot while in the mixer, but this is not recommended by some authorities*

### Many Found Idea Good

A check of concrete products plants in the larger manufacturing centers shows that the winter of 1924 and 1925 was especially productive to the active salesman. Manufacturers who had kept their plants closed during previous winters but who operated them during the period mentioned and engaged in active selling found it was possible to move practically their entire production. They found that many contractors who poured foundations during the summer months resorted to concrete masonry during the more severe months of the winter season, and that by cultivating these contractors a goodly business could be worked up. This class of men who have started cultivating contractors and builders during the summer months, with an idea of getting their winter construction business, it is needless to say, will never shut down again during the winter months.

It was noticeable during the winter of 1924 and 1925 that not only the products manufacturer, but the contractors, realized that inactivity during the winter months could be overcome and that a large share of the overhead which had been carried with nothing to offset it during winter could be made into substantial profit. Actual checking of building operations revealed that more concrete products were used in this town than any other similar period in the history of the industry.

The experiences of these few manufacturers have been watched closely by competitive products men and as a result the winter of 1925 and 1926 will find more plants in operation and more salesmen on the road selling products during the winter months than ever before.

## Curing System Necessary

In order to insure prompt delivery of a good product practically all of these manufacturers operating in winter have installed a curing system of some kind. Most of these are installing the exhaust steam method which consists of discharging steam at low pressure into the curing chambers. Practically every plant conducts the steam to the curing room through pipes running along the floor. In these pipes are small openings about one-eighth inch in diameter and placed at intervals of three or four feet along the pipe line. Small pet cocks are placed in these openings and as the curing room is filled from the back forward the pet cocks are opened. Some manufacturers, in order to hasten the curing proposition, have placed canvas curtains in the curing rooms at regular intervals. As soon as a portion of the room is filled, the curtain can be dropped, the steam turned on and the product immediately have the benefit of the heat. In order to be safe, this process should be carried on during the winter months for at least forty-eight hours, and the temperature should reach a maximum of 100 degrees. This is not as costly an operation as is imagined. Usually a low pressure boiler suitable for curing can be secured at a low cost. With an outside temperature of zero, a 15 h.p boiler will keep a curing room of 10,000 cubic feet capacity at the 100 degrees temperature mentioned above.

In preparing his plant for winter operation, if he already has a steam curing system installed, the manufacturer should see to it that all doors are absolutely air tight and there are no drafts through the curing room which sap the heat which should go to the product. In some of the more severe climates, hay or straw is placed on the top of the curing rooms and around the sides during the winter months, the manufacturers feeling that this precaution and expense more than pays for conserving the interior heat.

## Plan for Aggregates

Another precaution that should be taken early in the season, but which easily comes at the last minute, is that of securing adequate storing space for a supply of aggregate. Aggregate stored outside will become frozen and lumpy and even stored under a protecting shed will have to be thawed before it can be used satisfactorily. A temporary shed can be built at a reasonable cost and manufacturers who built them last winter with the idea of dismantling them in the spring found these sheds such a good investment that they added to their premanence during the summer months.

In connection with the outside ground level storage bin the well equipped plant will have in addition an overhead storage bin, around the walls of which are steam pipes. Aggregate can be run into these bins, steamed during the night and be in shape for use early the following morning, thus not delaying the plant operation.

Where there is no shed for storing a large supply of aggregate, or space is not available for a stock pile, aggregate can be secured from sand and gravel producers in carload lots. The problem of unloading a car, even with the temperature 20 degrees below, has become a simple procedure with manufacturers. The same boiler that furnishes steam for curing also furnishes steam for loosening up the frozen aggregate in these cars. A hose is connected with the boiler, and inserted in the end, is a piece of cast iron pipe that can easily be worked down

*This plant is well prepared for a cold winter. Everything is under cover*

*You can have a stock like this for the peak of the spring rush if you keep going this winter*

*A steam jet will do wonders in thawing any frozen material in or out of the cars* into the center of the car and at various points along its length in a suprisingly short time. The steam from this hose will soften even the most rigidly frozen aggregate and make it easy to unload. A worth while precaution when using this method of loosening aggregate is that of placing a canvas or paulin over the top of the car while the steam is on. This will not only conserve steam, but considerably hasten the time of thawing.

### Don't Use Dynamite!

Some manufacturers have attempted to loosen frozen aggregates in the cars by means of charges of dynamite. This is probably the poorest method that could be used, as invariably the bottom of the car is blown out and the products manufacturer has an expensive bill to settle with the railroad company for their car.

Even after the aggregate is unloaded from the cars and is in a condition to go into the mixture, it is well to have it heated for satisfactory work during winter months. This can be done with the same steam hose that was used for unloading cars and in many places we now find hot or warm aggregate being used in making concrete products during winter months.

Another precaution that is now being taken in many plants in addition to having the aggregate heated is that of using heated water for mixing. This water can be heated with a steam hose similar to that used for loosening aggregate in cars and heating it before mixing.

These two precautions are primary in importance as far as winter manufacturing is concerned. Care should be taken, however, to see that concrete products are properly cured before being put out in the yard, as releasing them from the curing rooms too soon is as bad a practice as employing no curing methods at all.

### Heat the Face Plate

Many manufacturers have had trouble not only during the winter months, but during the cool months of spring and fall when making a faced product of having the facing stick to the face plate, resulting in a spotty looking product. This can be overcome if some method of heating the face plate is employed. Some manufacturers simply use a gasoline torch similar to that used by the street corner ballyho artist of patent medicine fame. Other more progressive manufacturers have a gas jet run down in the machine directly under the face plate. This is kept going with a small flame during the cool months and results in the face plate being heated just enough to do away with sticking. An alternate of this system is that of placing an electric grid beneath the face plate. This, however, is usually a rather expensive method and is not to be recommended when it is possible to use either one of the two mentioned above.

### Stop Heat Losses

It will be a wise proposition for any products manufacturer to check over all openings in this plant during the fall months and early winter and see that there are no leaks or vents that are taking the heat from the plant or causing drafts that may not only affect his products, but the working spirit of the man he employs.

The more progressive manufacturers now realize that twelve months of operation instead of nine or ten months means twelve months of profit. The smaller manufacturers will become progressive by following the larger ones. With the increased production during the winter months sales competition will naturally become stronger and if the experiences of the past few seasons continue to be duplicated, it is only a short time when twelve-month operation will be taken for granted. The products manufacturer must realize that the burden of idleness during the winter season falls most heavily on his employees and on the public which he serves. Nine or ten month operation raises construction costs and idle time represents wastes and direct losses, not only to himself alone, but to the construction industry in general, his employees and the people he is serving.

The surprising thing that many manufacturers found out last winter was that there was a real demand for their product during the winter. How much they had contributed to make this demand themselves they little realize. However, winter operation of products plants is with us and the plant that keeps its doors open and machinery runing twelve months of the year is marked by the construction industry as a progressive plant and a help to the industry.

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## Lowell Joins Benedict Stone

Benedict Stone, Incorporated, with a large plant at Chicago, announces the appointment of John W. Lowell of Chicago as vice-president.

Mr. Lowell has just resigned his position as assistant manager, Service Bureau, Universal Portland Cement Company, with whom he has been associated for the past fourteen years.

Mr. Lowell is a graduate in civil engineering from the University of Wisconsin, and previous to his joining the Service Bureau of the Universal Portland Cement Company, he was connected in engineering capacities with the U. S. Geological Survey, Bion H. Arnold, Isham Randolph and the Illinois Central Railroad.

Mr. Lowell's years of experience and research in the concrete industry and, particularly in the manufacture of concrete products, have brought him into prominence as an authority, and have made him especially fitted for his new work, involving the making of the highest grade of manufactured stone.

Benedict Stone, Incorporated, of Chicago is affiliated with Benedict Stone Corporation of New York and Canadian Benedict Stone, Ltd., of Montreal.

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## Construction Council to Meet in Chicago

Attention is called to the fourth annual meeting of the American Construction Council, to be held at the Congress Hotel, Chicago, from November 18 to 21. It should result in things of benefit to the industry, if the plans of the organization can be worked out.

One of the important features of the meeting will be a national conference on Better Building. Two days will be devoted to this subject, and will include discussion by builders, architects, engineers, investment men, insurance experts, manufacturers, labor officials, public officials, and others interested in the subject. Craftsmanship and apprentice training will be discussed. Action has already been taken by the Council toward better home construction conditions, and this meeting should prove interesting and constructive.

The third day's session will be devoted to matters relating to the stabilization of business conditions in the construction field, together with a committee report on publicity measures to aid the same. There will also be a session devoted to local building congresses, and to arbitration in the construction industry. The Saturday session will take the part of a national conference on highway construction, and better methods in that portion of the field. Group meetings will be held throughout the sessions for the purpose of talking over special problems.

# Concrete Used on Tall Apartments

## The Detroit Towers Apartment Building Marks a Distinct Advance in Design—$50,000 Saved by Using Reinforced Concrete—Unusual Features of Design—Field Control of Concrete Provided—Speed in Construction Gained

By WM. F. ZABRISKIE
Vice President, Gabriel Steel Company, Detroit

The Detroit Towers Apartment Building is believed to mark a distinct point in the advance in the use of reinforced concrete construction in buildings of more than usual height. While definite data is lacking, the writer has been unable to discover records of any other building built of an equal height throughout its entire area.

The building is very irregular in plan, and a glance at the typical floor framing plan will indicate a considerable number of cases where unusual construction was employed in the exterior spandrel beams.

Another point out of the ordinary is the proportion of height to breadth, and its relation to the design of the wind-bracing in the frame. Considering all these points, it appears evident that if reinforced concrete can be successfully and economically used in such a structure, it is worthy of being given serious consideration as a form of construction to be used in high buildings generally. The following description of the building will attempt to bring out the features above referred to.

### Residential Occupancy

The structure is to be occupied as an ultra-high-grade apartment building. It will contain 34 apartments arranged two on each floor. Each apartment will contain an entrance hall, living room, library, dining room, two master bed rooms, two master baths, two maid's bed rooms, maid's bath, kitchen and butler's pantry. An idea of the type of apartment may be gained from the fact that the living rooms facing on the river end of the building, are approximately 20x30 ft. in dimension. In plan, the building has a length of approximately 105 ft. with a width at the river, or south end, of 60 ft. and at the north end of 44 ft. There are about 5400 sq. ft. of floor per story.

There are, in all, nineteen stories above the grade. The ground floor is devoted to laundry, heating plant and other mechanical equipment. The mezzanine floor contains a general reception and dining room, janitor's apartment, etc. Above this there are seventeen apartment floors, each containing two apartments.

The building is located directly upon the bank of the Detroit River, and is so planned that all apartments have an excellent view of the water.

### Placed on Piles

The soil conditions, as disclosed by preliminary borings, indicated the advisability of piling, and test piles were driven to determine in advance the proper length. There were, in all, 627 timber piles used, varying in length below cut-off from 35 to 45 ft., the longer piles being used on the river end of the structure. The pile cut-off was approximately six feet below the existing grade, and below the mean water line. The pile capacity used in foundation design was twenty tons per pile.

The general type of floor construction was given thorough study. It was considered very essential to keep all dead loads to the minimum in order to prevent excessive size of the columns. The floor construction finally adopted was an 11-in. plus 2-in. removable steel floor tile design with interior girders 13 in. in depth, and concealed in the thickness of the floor slab. This arrangement seemed to be necessary in order to prevent interference of beams with the room plan, which was very irregular, and which precluded the possibility of beams projecting below the slab in most locations.

The architect's plans called for finished hardwood floors in all principal rooms. In order to avoid the weight of any form of sleeper fill, wooden sleepers were anchored to structural concrete slab by means of sheet metal anchors cast in the slab. As the finished flooring was laid the space between sleepers and under the floor was filled solidly with mineral wood, to serve as a sound deadening material and a fire stop. The weight of the entire floor finished was assumed in the load calculation as 6 lbs. per sq. ft. Metal lath and plaster ceilings were provided throughout, attached directly to the underside of the concrete floor slab.

*Six floors to go and the exterior will be done. This is how the Detroit Towers Apartment Building looked on July 15*

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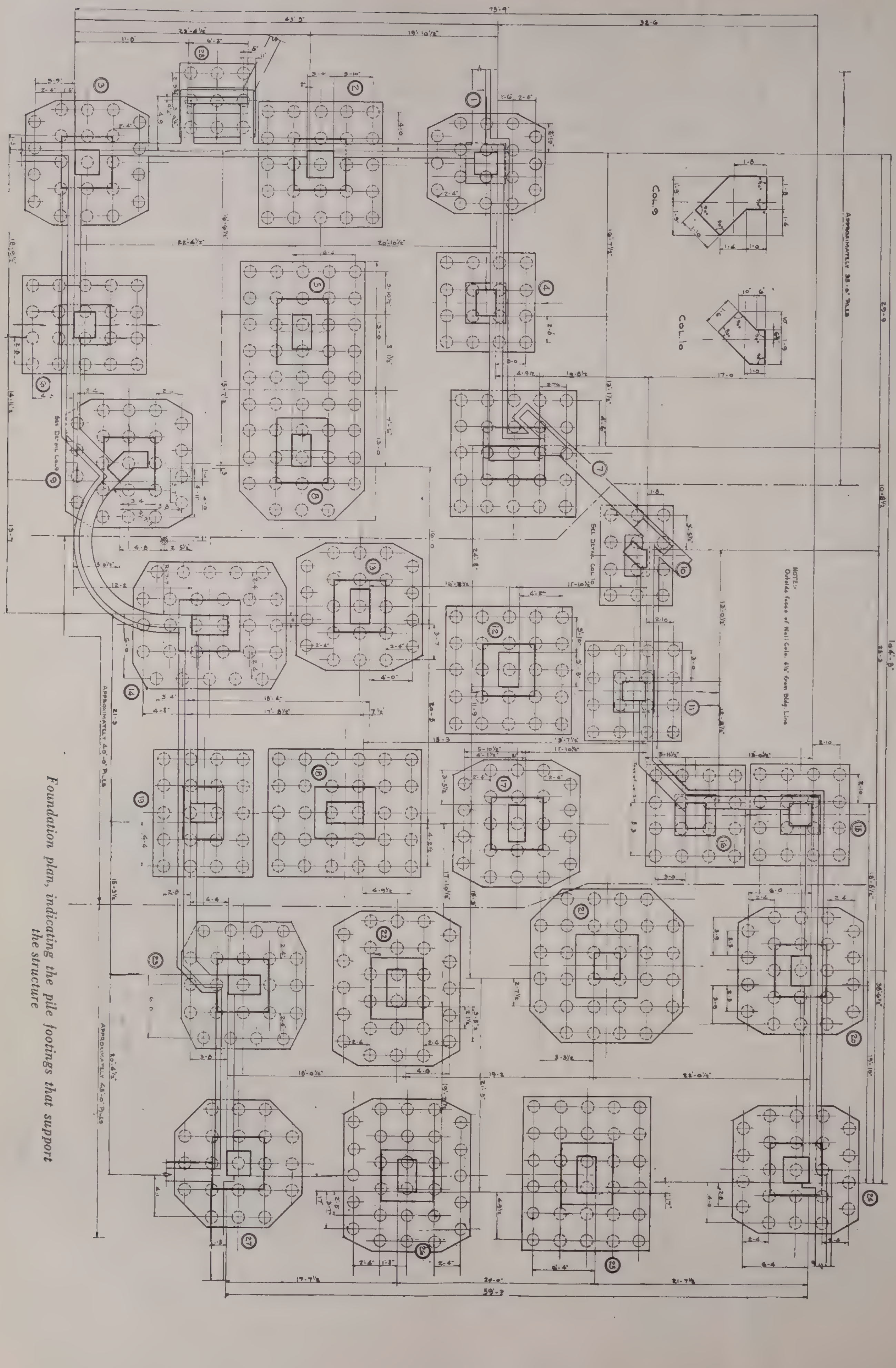
*Paper presented before the Concrete Reinforcing Steel Institute, Semi-Annual Meeting, Chicago, September 23, 1925.



APPROXIMATELY 33'-0" PILES
COL. 9
COL. 10
NOTE:- Outside faces of Wall Cols. 6½" from Bldg. Line
SEE DETAIL COL. 9
SEE DETAIL COL. 10
APPROXIMATELY 40'-0" PILES
APPROXIMATELY 45'-0" PILES
75'-9"
45'-9"
32'-6"
39'-3"
1
2
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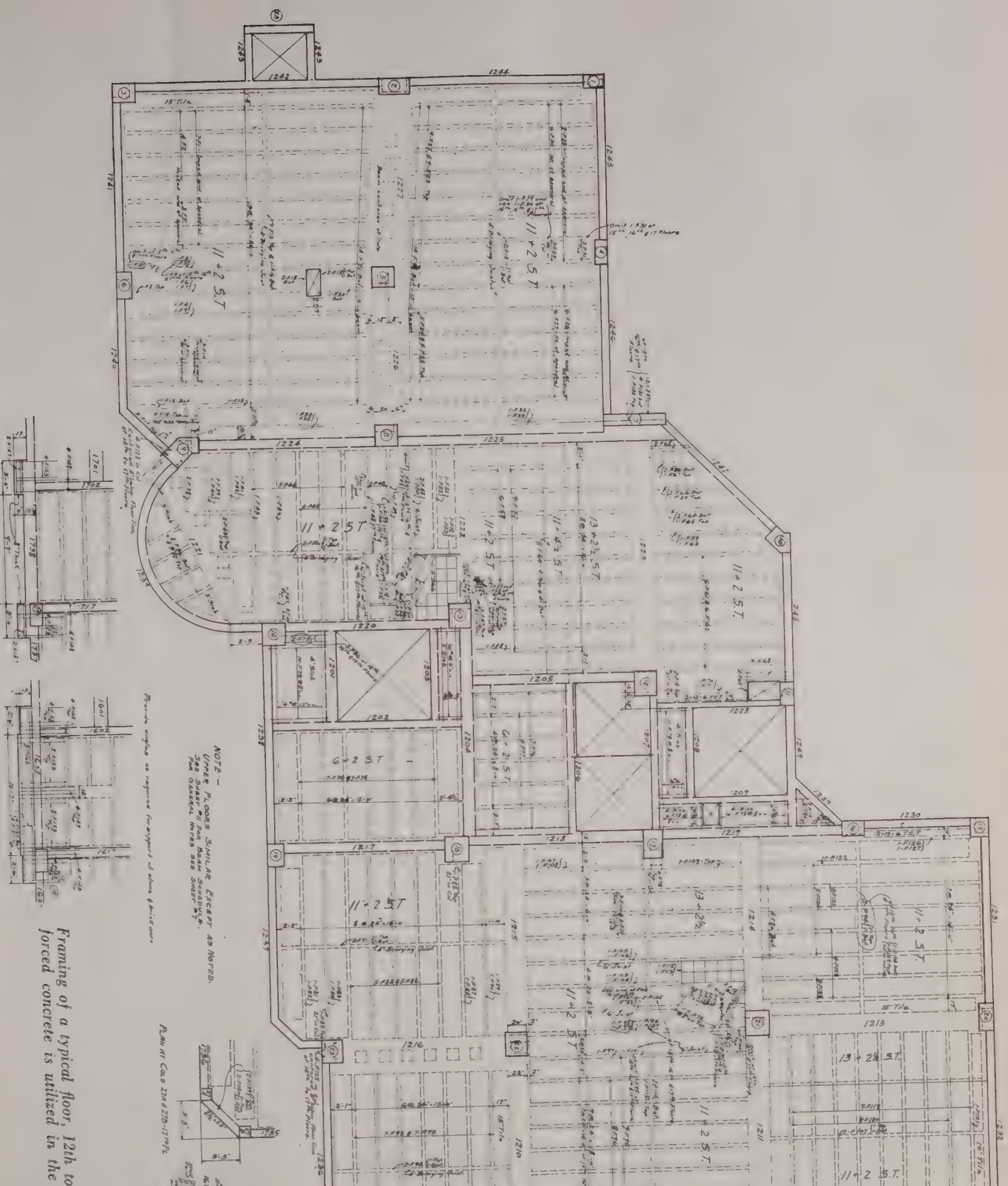
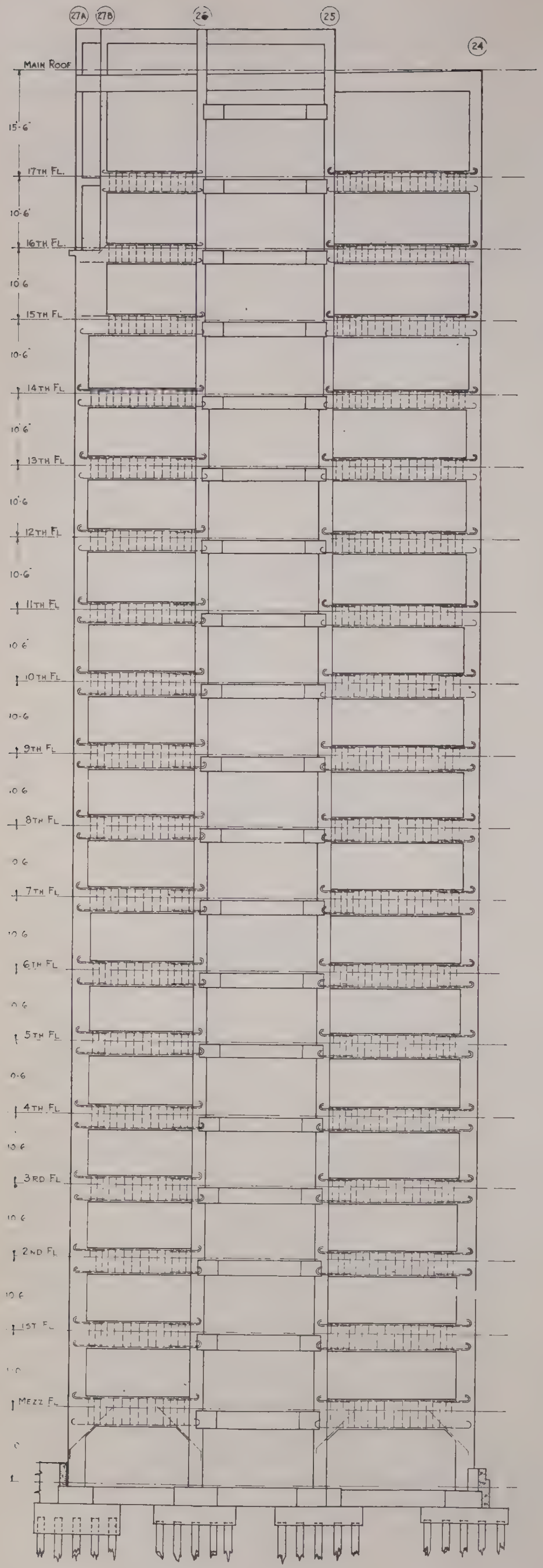
*Foundation plan, indicating the pile footings that support the structure*

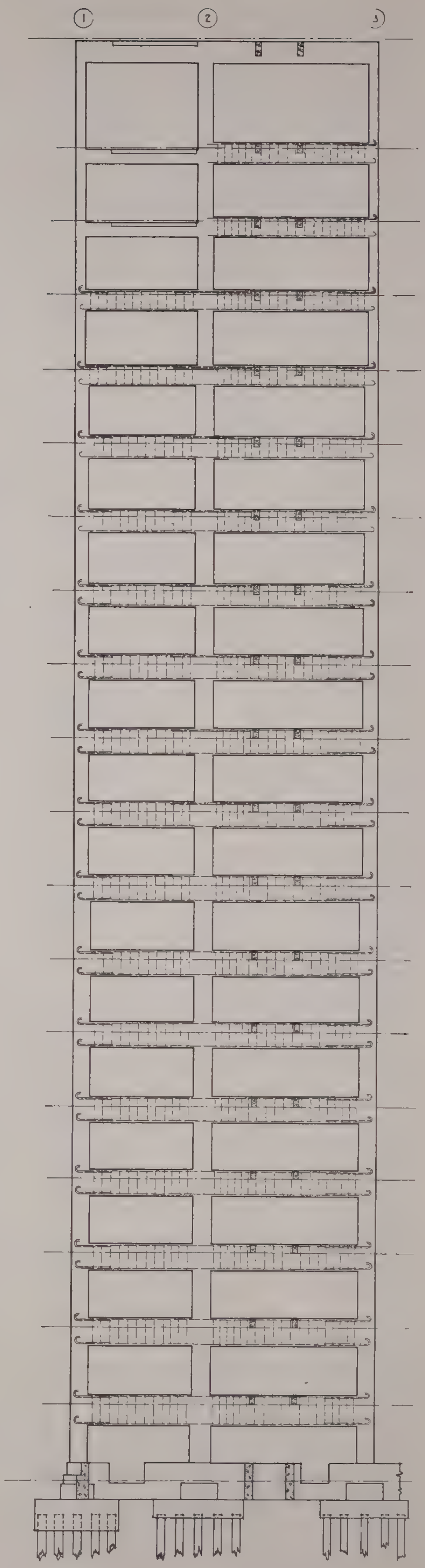

NOTE:- Upper floors similar except as noted. See sheet 21 for beam schedule. For general notes see sheet 27.
Provide anchors as required for support of stone & brick work
PLAN AT 17TH FL.
PLAN AT 16TH FL.
PLAN AT COLS 27A & 27B-17TH FL.
PLAN AT COL 27-16TH FL.
11+2 S.T.
13+2½ S.T.
6+2 S.T.
15" Tile
1244
1225
1212
1233
1235
1232
1230

Framing of a typical floor, 12th to 17th, showing how reinforced concrete is utilized in the design of tall buildings



SOUTH FRAMING ELEVATION

*Framing elevations, showing extra deep spandrel beams that provide wind bracing on outer bays*



NORTH FRAMING ELEVATION

Wind-bracing in the north and south directions was provided for entirely in the exterior columns and spandrel beams. Wind-bracing in an east and west direction was provided for in the line of the north and south walls, and by two rows of interior columns where it was possible to permit the beams to project below the floor slab.

## Spandrels Concealed

Spandrel beams were made of a uniform thickness of 8½ in. so that they were entirely concealed inside of the brick enclosing wall. On account of the fact that the large part of the wind stresses were carried by the spandrel construction, these beams were of considerable depth, the deepest beams being 52 in. The bottoms of the spandrel beams were in all cases located to serve as lintels over the various window openings. In the design of the columns, it was necessary to adapt their form to fit conditions caused by the architectural floor plans. Most of the exterior columns were made rectangular in form with the long dimension of the rectangle parallel with the wall. The maximum load carried by any column was 1,148,000 lbs. In order to keep the columns to a minimum size a 1:1:2 mix was used for the lower eleven stories. Approximately 4 per cent of verticals were used in lower sections of columns.

The size of the base section of the most heavily loaded columns was 33 in. square. Other heavily loaded columns were rectangular in form but of approximately the same area. Although these columns are of more than ordinary size, it was possible to arrange the partitions so that the columns did not interfere with the layout of the rooms. In the complete structure, it is surprising how inconspicuous the columns are in any room.

In the cases of many of the columns the stresses due to flexture, were a large factor in the design of the column. In these cases reinforcing bars were placed so as to give a maximum value of resisting moment for the column. Detailed plans were prepared, showing spacing of column bars and dowels for all such cases.

The reinforced concrete work was designed, in general, in accordance with provisions of the Detroit Building Code, which permits a tensile stress of 20,000 lbs. per sq. in. for intermediate grade billet steel. The maximum compressive stress in stayed columns was 675 lbs. per sq. in. The maximum compressive stress on 1:2:4 concrete in flexure was 750 lbs. per sq. in. All stresses were increased by 35 per cent for combined wind and direct loads.

Field control of the concrete was obtained by slump tests taken throughout the progress of the concreting operations. A slump of between 5 and 6 in. was obtained in pouring the steel tile floor slabs and a slump of approximately 4 in. was used in pouring columns and beams. A small quantity of hydrated lime was used throughout, the quantity being from five to seven per cent by weight of the cement. Six by six inch test cubes were taken from both slab and column concrete and crushed after 28 days. Cubes of column concrete tested between a minimum of 2800 lbs. per sq. in. and a maximum of 3870 lbs. per sq. in., averaging over 3000 lbs. per sq. in.

## Concrete Economical

While the project was in preliminary form, several tentative designs were considered, including a complete steel frame and a composite frame, using structural steel in the lower stories. Since the final design varied greatly from preliminary studies, a complete new estimate was made of the structural steel work as a matter of ascertaining the comparative costs. The following tabulation is submitted to show the relative cost of the construction with what the cost would have been had a structural steel frame been employed:

### CONCRETE FRAME DESIGN (As Constructed)

| | | |
|---|---|---|
| Piling | | $ 12,500 |
| Pile Capping—484 yards, including Excavation and Forms | | 9,500 |
| Column Concrete— | | |
| 1:1 :2 617 yards at $11.50 | $7,095.50 | |
| 1:1½:3 222 yards at 10.50 | 2,331.00 | |
| 1:2 :4 38 yards at 9.00 | 342.00 | |
| | | 9,768 |
| Column Forms—24,000 square feet at .25 | | 6,000 |
| Floor and Beam Construction—2,631 yards | | 24,995 |
| Floor and Beam Forms—including Removable Steel Tile | | 25,200 |
| Reinforcing Steel—including Engineering | | 27,450 |
| Placing Reinforcing Steel—370 tons at 15 | | 5,725 |
| | | $121,138 |

Total Yards of Concrete—3,992 Cubic Yards

### STEEL FRAME DESIGN

| | |
|---|---|
| Piling | $ 11,800 |
| Pile Capping—including Excavating and Forms | 8,900 |
| Column Fireproofing—1:2:4 434 yards at 9.00 | 3,906 |
| Column Forms—including Brackets for Wind Bracing—18,000 at .25 | 4,500 |
| Floor Concrete and Beam Fireproofing | 24,995 |
| Floor and Beam Forms—including Removable Steel Tile | 23,800 |
| Structural Steel—including erection—900 tons at 90 | 81,000 |
| Reinforcing Steel—100 tons | 6,800 |
| Setting Reinforcing Steel—100 tons at $15 | 1,500 |
| Engineering Design | 4,000 |
| | $171,201 |

It will be noted that there is an indicated saving of approximately $50,000 by the use of reinforced concrete. This amounts to a saving on the cost of the structural frame of approximately 30 per cent. Looking at it from another angle, it means that the cost of the structural frame would have been increased approximately 42 per cent had structural steel been employed instead of reinforced concrete.

## Saved Time

In addition to the large saving indicated, the contractors state that they believe time was actually saved in the construction of the building due to the selection of reinforced concrete. This is due to the fact that the construction was begun almost simultaneously with the preparation of the design. It would have, therefore, been impossible to have obtained base sections of the structural steel columns, fabricated them and commenced erection when the pile cappings were completed and ready to receive steel work.

Although the building was of an unusually complicated construction, very few difficulties arose in the field. The work was prosecuted very rapidly, and was completed ahead of the schedule set. The first piles were driven March 1 and the first concrete for pile capping was placed April 1. Pouring of the roof slab was completed on August 10. Unless delayed by unusual weather, the floors were completed on the average of one every five days. The brick masonry followed the pouring at about the same rate of progress. It was generally about five or six floors below the story being poured. Final brick work was completed on September 19. The interior partitions were carried up at about the same rate as the brick enclosing walls. Plastering and installation of finish is now being carried on.

Architect's plans on the structure were prepared by Walter W. Ahlschlager of Chicago. All construction work was performed by the Walbridge-Aldinger Company, general builders, of Detroit. The building was constructed under field supervision of T. W. Smith, as architect's superintendent, and J. H. Gowan, as contractor's superintendent. Structural designs were prepared by the Gabriel Steel Company of Detroit, under the supervision of W. S. Wolfe, chief engineer.

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The day of large structural members is past.

# Unit Labor Costs Are Easily Found

## A Simple Method of Arriving at Unit Labor Costs That Can Be Used to Good Advantage on Concrete Work—A Daily Time Card That Works—Time Is the Important Element, Not Money

By ARTHUR J. PEEL
Consulting Accountant

The subject of unit costs of production is claiming the attention of the building and associated industries, in an ever increasing degree; but in no branch of the construction business is this of more importance than in concrete work. The comparatively recent developments in concrete construction, and the continual activities in research work, have made it imperative that scientific cost-accounting be applied to the activities of the industry.

Too often when the subject of cost-accounting is mentioned to a man in the construction industry, or in any of its allied branches and trades, he immediately conjures up something very complicated and beyond his normal range of intelligence. Not all building men take this attitude, of course, but too many of them do. Strange as it may seem, these are to be found not only among the men who have worked up from the ranks of mechanics and tradesmen, but among those who have come into the industry through the doors of the technical college, and the engineering profession, and who, in some cases, are prominent in the industry. At the same time, it must be admitted that the greater need for simplified cost-accounting is to be found among the ranks of the smaller contractors, who have to rely partly, or wholly, on their own bookkeeping knowledge and elementary methods of arriving at costs. Consequently, costs are often a matter of rough estimating and casual figuring.

### Many Have Real Systems

In the course of a systematic and extended investigation of costing methods and practices in the building industry, including general contracting, painting and decorating, and plumbing and heating, and more recently, concrete work, I have seen and examined a large number of various forms and records. Many of these are quite good, and are effectual for the purpose for which they are used. Among the larger and leading construction corporations, are to be found scientific systems of accounting that are as complete as modern accountancy can develop. But these detailed and somewhat complex cost systems demand trained and expert men to keep them going smoothly, and this means high salaries and an adequate accounting organization. With the large contractor this is not only necessary, but it pays. With the smaller man it is just as necessary—that is, cost-accounting—but it doesn't pay to maintain an accounting organization, or even to employ a high-priced cost accountant. Must the smaller man, then, deprive himself of the benefits that accrue from developing and maintaining a system of cost-finding which will furnish him with accurate unit costs of specific and classified operations, in a particular line of work? This is where the problem of simplification of cost-finding methods—to the point where such practice becomes available to the smaller contractor, and even to the one-man concern—comes into the picture.

### System Ever Needed

For some years I have been interested in the simplification of cost-accounting practice, and through the trade magazines and other channels, I have been hammering the gospel of simplified cost-accounting for the mechanic and the tradesman—the man who is usually not of the accounting type of mind and to whom all manner of figuring is an abomination. Unfortunately, no man can be in business and escape from the subject of mathematics in one form or another, and whatever one may feel about the matter personally, it is a popular fallacy to imagine that to have no proper system of accounting is simpler and easier, than to run a real system. In the course of a varied and interesting professional career in three countries, I have discovered that more time is wasted and lost by men in business and trade, through a lack of proper bookkeeping and cost-finding methods, than can possibly be lost when one has a real honest-to-goodness system which is properly and conscientiously operated.

An unenviable notoriety for wide variations between estimates covering the same project, or class of work, has brought the subject of cost-finding and its relationship to estimating, very much to the fore in the building and associated industries. As a matter of fact, being familiar with other lines of business, such as printing, interior decorating, and others, I am of the opinon that there is not much to compare in any industry that is dependent on accepted estimates, for its business activity.

### Labor, Material, Overhead

The elements of Cost, are, of course, Labor, Material, and Expense (or Overhead). The most important of these is Labor. The first problem that confronts the man who is desirous of developing unit costs on specific work in connection with concrete operations, is the proper recording of *Labor Time* on the job. Labor cost is more subject to fluctuation than either material or overhead expense. For instance; while living in the South for a few months, I was interested in the cost-accounting work in connection with the erection of a large hotel in North Carolina. The Truscon Steel Company of Youngstown, Ohio, had the contract for the erection and placing of the steel forms for the concrete pillars, columns, walls, floors, and so forth. All this was one of the first jobs undertaken under this particular process—one that eliminated the use of wooden forms for concrete—it was very necessary to keep a very close and accurate check on the cost of individual units of work. By this means it was discovered that the labor cost increased with every additional floor after the first four or five, though the actual work and material remained the same. The explanation for this, was, of course, that the higher the elevation from the ground, the more careful became the mechanics who were hanging on the edge of steel forms by their eyebrows. This must be true of concrete workers to a large degree, but how many contractors take this into consideration in estimating? And those who do; what sort of data have they on hand which will tell them just how much it costs to set concrete columns or beams on the ninth floor in comparison with the cost of similar work on the first floor? In this day and generation, profits are *saved* just as much as *made.* but to *save profits, we must beat estimated costs,* and we can never beat costs until we *know* them. The Truscon Steel Company knew exactly how much it cost in labor for the first floor, the second, the third, and so on up to the twelfth—if that was the height of the building. And because they know for a fact that the labor cost of work on the twelfth floor was 20 per cent more than it was on the first—the figures are used only as an illustration—they knew exactly how to estimate on another job of the same nature.

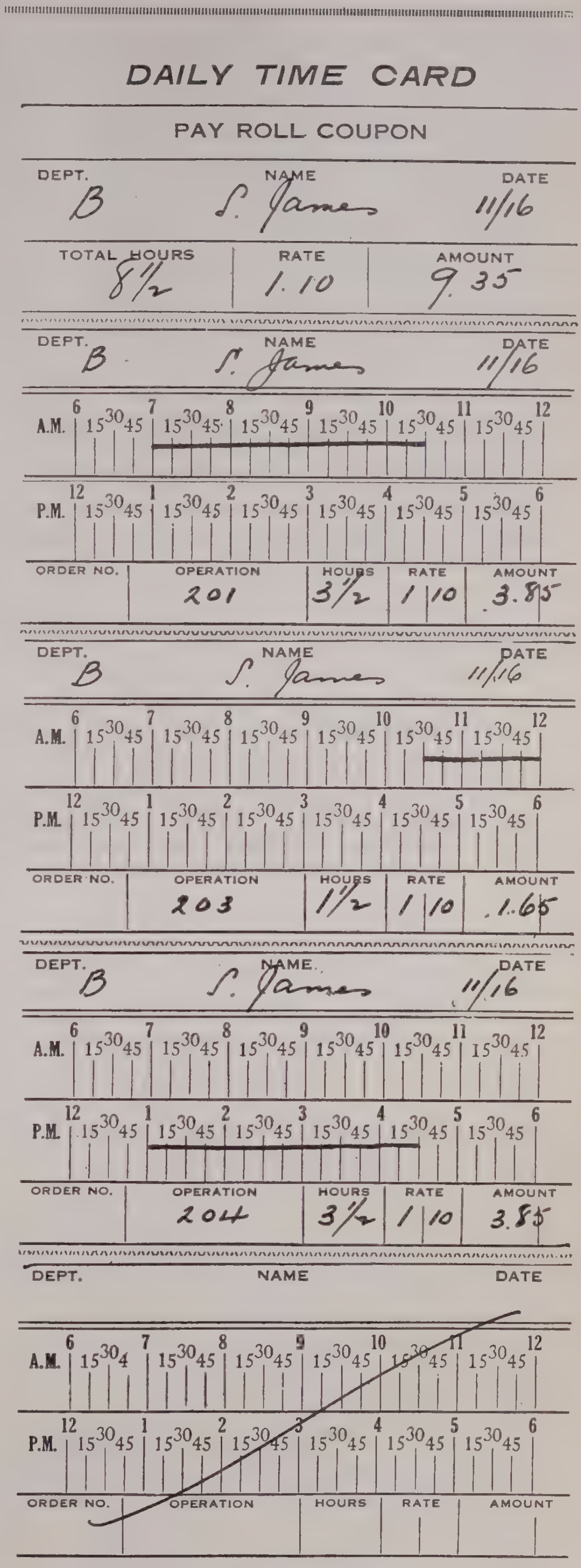
## A Daily Time Card

But as the purpose of this article is to present one or two simplified methods of arriving at unit costs—methods which ought to appeal to the man who has little or no opportunity to avail himself of expert accounting assistance—let us get down to the actual problem. One method of recording and classifying labor costs on concrete work that has recently come to my attention, and is—as far as I can discover—something unique, is that used by the Housing Company of Boston. This firm is continuously engaged in research work and in carrying on experiments in building materials. For this reason an accurate and scientific cost system, which will develop unit costs on individual operations, is essential. Yet a member of the organization has developed a form of labor cost ticket, so simple yet so effective, that I feel it is worth bringing to the attention of those who are still searching for simplicity combined with efficiency. This particular card has its limitations, of course, but it will meet the needs of a large number of concrete men, of that I am convinced.

One of the most common difficulties connected with the matter of cost-recording, is to discover a simple means of getting accurate information *on the job*—at the place where the work is actually being done, and at the time it is being done. But unless information is taken on the job, it is of little value. Whether this shall be left to the timekeeper, the gang foreman, or the individual worker, is a question to be decided by the contractor alone, and will depend entirely on local conditions and organization. With a small force of regular men who can be trusted to give the necessary care and attention to recording time accurately, the problem is simplified. The Daily Time Card shown herein is used by the Housing Company with a small force of men who are engaged chiefly in experimenting, but it is used also in actual building operations undertaken by the company. Its application to a number of other departments of work is entirely practical.

## A Five-Section Card

The reader will note that the card consists of five sections, each separated from the other by a perforated line. The top portion of the record—"Pay Roll Coupon"—is for the purpose of Payroll record, only, and at the end of the day this is detached and passed to the office as the man's daily record of payroll time. The other sections are for the purpose of recording time worked on specific jobs, or operations. The time spent on a certain class of work is marked, as indicated on the card exhibit. Provision is made for a man to work on four different operations during the day, if necessary, or as required. This may be extended, of course, by having a longer card



DAILY TIME CARD

PAY ROLL COUPON

| DEPT. | NAME | DATE |
|---|---|---|
| B | S. James | 11/16 |

| TOTAL HOURS | RATE | AMOUNT |
|---|---|---|
| 8½ | 1.10 | 9.35 |

| DEPT. | NAME | DATE |
|---|---|---|
| B | S. James | 11/16 |

A.M. 6 15 30 45 7 15 30 45 8 15 30 45 9 15 30 45 10 15 30 45 11 15 30 45 12

P.M. 12 15 30 45 1 15 30 45 2 15 30 45 3 15 30 45 4 15 30 45 5 15 30 45 6

| ORDER NO. | OPERATION | HOURS | RATE | AMOUNT |
|---|---|---|---|---|
| | 201 | 3½ | 1.10 | 3.85 |

| DEPT. | NAME | DATE |
|---|---|---|
| B | S. James | 11/16 |

A.M. 6 15 30 45 7 15 30 45 8 15 30 45 9 15 30 45 10 15 30 45 11 15 30 45 12

P.M. 12 15 30 45 1 15 30 45 2 15 30 45 3 15 30 45 4 15 30 45 5 15 30 45 6

| ORDER NO. | OPERATION | HOURS | RATE | AMOUNT |
|---|---|---|---|---|
| | 203 | 1½ | 1.10 | 1.65 |

| DEPT. | NAME | DATE |
|---|---|---|
| B | S. James | 11/16 |

A.M. 6 15 30 45 7 15 30 45 8 15 30 45 9 15 30 45 10 15 30 45 11 15 30 45 12

P.M. 12 15 30 45 1 15 30 45 2 15 30 45 3 15 30 45 4 15 30 45 5 15 30 45 6

| ORDER NO. | OPERATION | HOURS | RATE | AMOUNT |
|---|---|---|---|---|
| | 204 | 3½ | 1.10 | 3.85 |

| DEPT. | NAME | DATE |
|---|---|---|
| | | |

A.M. 6 15 30 4 7 15 30 45 8 15 30 45 9 15 30 45 10 15 30 45 11 15 30 45 12

P.M. 12 15 30 45 1 15 30 45 2 15 30 45 3 15 30 45 4 15 30 45 5 15 30 45 6

| ORDER NO. | OPERATION | HOURS | RATE | AMOUNT |
|---|---|---|---|---|
| | | | | |

*This Daily Time Card, perforated into five sections, tells at a glance what any unit of work actually costs in labor expended.*

and adding one or two more sections. At the end of the day, when the card is turned in, the sections are detached from each other and all cards showing the same operation number are placed together. All that is then necessary to obtain the total time and labor cost on any one operation, is to run them off on an adding machine, and the necessary information is quickly available. This method is perhaps the simplest and most effective, so far, that has been devised. The pay-roll cost of operations is obtainable because the man's rate is shown on each section. The amount can be computed by the cost-clerk, and it is not expected that the man will do this before turning in his card. It will be noticed that not only does this system provide pay-roll time for pay-roll purposes, and pay-roll time for costing purposes, but it also shows up idle, or unproductive time. Unless the time marked off on the four sections following the coupon total the amount of pay-roll time, the difference must be idle or unproductive time. This may be useful information under certain conditions.

### Use With Large Gangs

Where a large number of men are employed, a number of whom are engaged on the same specific operation at one time, it would be advisable for either the foreman or the timekeeper to make up the men's cards; and in order to cut down the clerical work to a minimum, a gang punch could be used with much advantage in punching the starting and finishing time. A whole bunch of cards could be punched together if all the men start and finish at the same time, thus making only two operations. The "operation" number could be rubber-stamped on the cards, as also could the "order" number—where it was necessary to record this. In this way the foreman would do no actual writing. It is hard to conceive of anything that would eliminate unnecessary clerical work on the part of the foreman or timekeeper more than is done by a card of this character.

### The Important Data

At this stage let me emphasize something that may be quite thoroughly understood by the majority of readers. For the sake of some who do not realize the importance of it, I would say that TIME not *dollars,* is the vital information required for *unit* cost purposes. It may be interesting to know that it costs, let us say, $324.35 to mix and place 162 cubic yards of reinforced concrete; but what is of greater importance is to know that it takes 339 hours of laborers' time, 42 of engineers', and 16 of a finisher's, to mix and place 162 cubic yards. The dollar and cent cost is dependent entirely on the prevailing labor rate, which may be 75c, $1.25, and $1.10, respectively, today; but what will it be when we figure on the next job? We can't tell, of course, nor does it matter so long as we know that it takes so many *hours* of time to do the work. Then, getting down to units; it is of some value, of course, to know that in the week just completed the cost per cubic yard has been pulled down to $2.00 as compared with a previous average of $2.26; but it is of greater importance to realize that the men did in 2 hours, 27 minutes, what in the previous period averaged 2 hours and 58 minutes. This is thinking in terms of TIME, and the contractor will react quicker to the meaning of this when expressed in Time rather than in dollars. He will see to it—if he is alive to his opportunity—that the new low level of operating cost, is maintained, if at all possible.

It is not my purpose at this time to go into the subject of material costs. It is understood, of course, that the cost of sand, cement, crushed stone or gravel; the cost of materials for temporary heat, and any other materials used, must be worked out on the basis of units of measurement or content. This is more than an accounting problem, it is an engineering problem. But if, for example, it is known that the material required for one cubic yard of concrete for blocks, in proportions to 1 :2 :2 is as follows: Cement 2 bbls. Gravel, 0.56 cu. yds. and Sand, 0.56 cu. yds., then the total cost of one cubic yard of concrete may be easily ascertained, and, until the prices of material change, may be accepted as a standard cost. But here, also, the important factor is not the dollar and cent cost of material, but QUANTITIES: when Quantities are known, price fluctuations will never confuse the concrete contractor when estimating.

## Manufacturers Hold Meeting in St. Louis

Taxation, bugbear of business, bugbear of industry and bugbear of the individual who tries to support his government and make both ends meet, was one of the principal things under discussion at the annual convention of the National Association of Manufacturers at the Hotel Statler, St. Louis, last month. It was analyzed in its national, state and local phases by delegates representing thousands of the greater and lesser manufacturers of the country attending from North, East, South and West.

This was the first convention of the association held outside of New York City in twelve years. Coming on the threshold of the opening of a most important session of Congress, the meeting took on something of the tone of an industrial parliament and definite action was formulated looking to the presentation to the national legislators of unified industry's views regarding the most pressing of national problems.

Among other subjects presented and discussed were immigration, transportation, tariff, commercial aviation, fuel, the divorcement of the government from industrial operations, the new policy of the federal trade commission, the strengthening of the federal judiciary and improvements in our patent system.

Labor conditions and employment relations were given special consideration, particularly those caused by the strike of the hard coal miners and those resulting from the employment of children and the presence of women in industry.

In preparation for the convention, which was the thirtieth of the organization, the National Association conducted from its headquarters in New York the greatest survey of trade conditions ever undertaken in the United States outside of the federal censuses. More than 50,000 postal cards have been sent out to manufacturers throughout the country asking questions, the replies to which not only will indicate present and future business conditions but also will give figures of the total manufacturing resources of the country and reveal the actual conditions of the labor market. The questionnaire called for statements of present trade, prospects for the winter, comparison with conditions one year ago, comparisons of stocks, production, sales and sales values now and last fall; statements as to increases or decreases in employment and wages within the last year and also, where it exists, as to shortage of labor and whether it is skilled or unskilled. To complete the survey it will be necessary to assemble, tabulate, classify and analyze by percentages from 350,000 to 500,000 groups of figures. The extent of this survey has been made unusually wide because, the Association says, "business conditions of 1925 are of an unusual character."

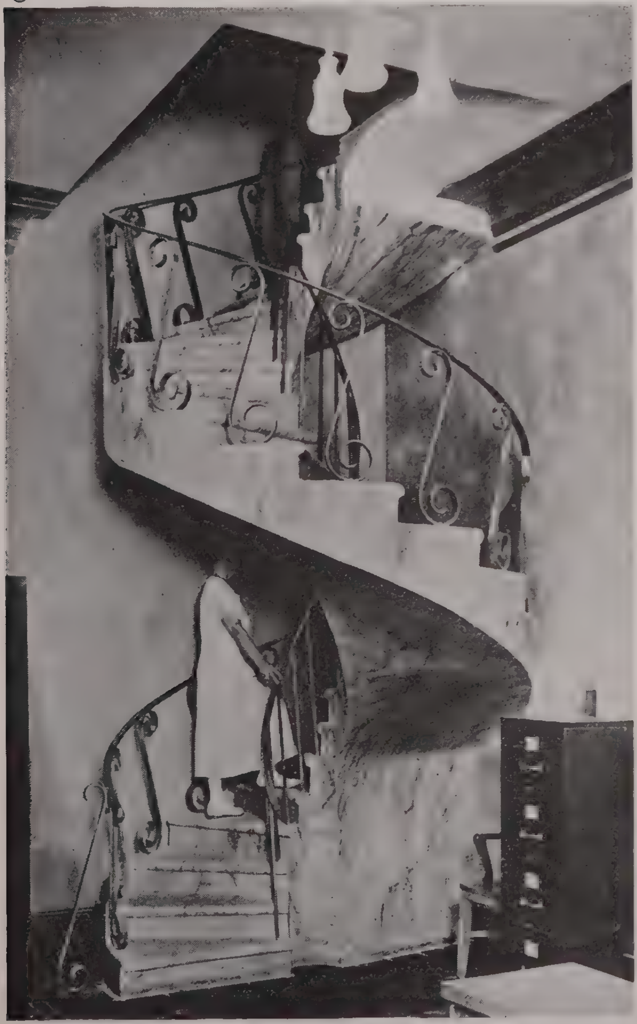
## They Said It Couldn't Be Done

The most unique staircase in the world—the only one of its kind in existence—has been built at Coral Gables, Florida. It is made of reinforced concrete, and in defiance of one of the first theories of architectural engineering.

The staircase, which is of the spiral, self-supporting variety, was planned and built by a practical construction man, against an architect's recommendation. When he first projected it he was told that it was "impossible." Such a thing was unheard of—it was doubtful whether it could be constructed "even in theory." Undaunted, he went ahead in his own way, and today it stands as a monument to his ingenuity and perseverance.

J. W. Ricketts, president of the Coral Gables Construction Company, is the man who performed the impossible. Retained to build the Coral Gables office of the Parker Printing Company, he saw an opportunity to introduce into the design of the structure a new and striking feature. A spiral staircase, to connect the first floor with the second, appealed to him as the one suitable and harmonious method.

Despite the forebodings of the architects, Mr. Ricketts felt that it could be done. Many long evenings were spent in poring over drawings, plans and calculations. Finally, after several weeks of work, a formula was evolved which seemed to promise success.



*This is the Reinforced Concrete Spiral Staircase that establishes a new precedent in design*

A mould was built exactly conforming to the measurements, reinforcing was set inside it, and the concrete was poured. When, some days later, the moulds were removed, he was rewarded by finding a perfect cast.

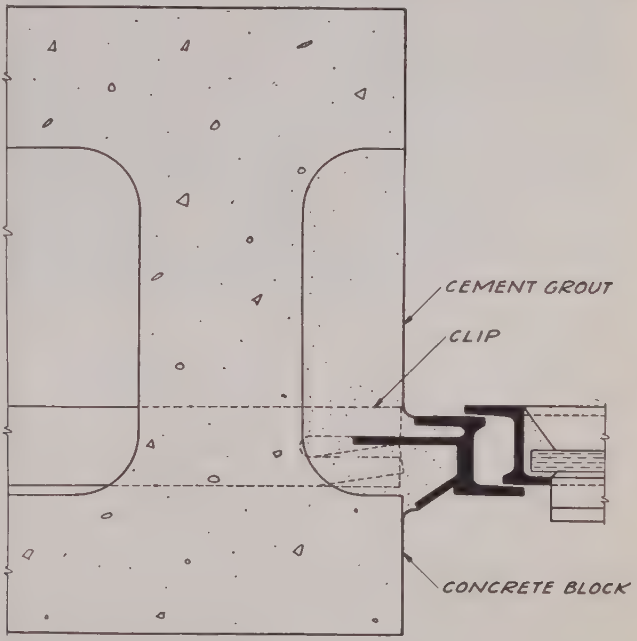
The staircase stood forth in perfect condition and tests proved it capable of withstanding a strain of 170 tons, with a carrying capacity of 4,800 pounds. With the exception of the two bottom steps, it has no supports whatever in the course of its upward spiral, being built upon a "perpendicular balance." It might, indeed, be continued upward for an indefinite number of stories without subjecting it to any excessive strain.

## Setting Steel Windows in Block Walls

### By JOHN K. BLITZ

Anchoring steel basement windows by means of metal clips set into the joints between concrete blocks is the method devised by a leading steel sash manufacturer for use in localities where blocks are not available with ends especially slotted to receive the jamb of the window.

The clip is an inch wide and eight inches long, with one split end. This split end projects toward the window, and the fin at the jamb of the latter fits into it. Four clips are provided with each window—two for each end. They hold the window firmly upright until the concave ends of the blocks can be filled in with cement grout, to finish the job.



*This is the way steel basement windows can be anchored in concrete block walls*

The window should be so located in the wall that the flaring leg on the outside face of the jamb meets the offset of the block, as shown in the sketch. Neatness and a tightly sealed joint between window and masonry are obtained by using the anchor clips in the manner described.

Have you a new and better way to do that odd job?
Send in that kink today!

## "Bill of Rights" for Trade Associations

The trade associations' "bill of rights" finally was affirmed recently when the Supreme Court denied the petition of the Department of Justice for a rehearing of the Government's cases against the Maple Flooring Manufacturers Association and the Cement Manufacturers Protective Association. In decisions on these cases at the last term the court enunciated the rights which trade associations generally may enjoy. Associations are permitted to carry on statistical services and their members are permitted to meet and discuss such information provided that they do not attempt to reach any agreement or concerted action with respect to prices or production, or restricting competition.

In seeking a rehearing the Department of Justice did not challenge the principle upon which the cases were decided but contended that the privileges thus granted are particularly susceptible of abuse, and actually were abused by the defendants, thus bringing the cases not only within the prior decisions of the court but within the very principle laid down by the court in the present cases.

John W. Davis, who conducted the case for the cement manufacturers, said after the court's action:

"Of all the charges made, the lower court disapproved only of the exchange of statistics which it thought permitted control of production and so affected prices. Its decree was based on that conclusion. The Supreme Court reversed this opinion by recognizing that statistical knowledge is a legitimate part of an industry's economic existence.

"Thus the cement industry, after years of unjustified charges, is free of illegal talent."

## "Healed" Concrete Is Strong

### By MICHAEL J. PHILLIPS

Professor Duff A. Abrams, of Lewis Institute, Chicago, was recently quoted to the effect that concrete cylinders, once cracked and then re-tested after a period of several years, were found to have a strength equal to two and a quarter times the strength originally developed.

The California State Highway Commission engineers have been following experiments with broken concrete for several years and corroborate in some degree the statement of Professor Abrams.

A specimen which had been previously broken was received by the Commission headquarters from Sacramento County. It was placed in the compression machine and developed considerably more strength than when first tested. This led to a series of tests in which specimens were broken at ten days, returned to storage water, and again broken at twenty-eight days. In nearly every case an increase of strength was noted.

Up to the present time seventy-four specimens have been broken. When re-broken at twenty-eight days, 88 per cent of the cylinders showed an increase in strength ranging from 0.2 to 74.5 per cent. The average of all specimens was 21 per cent. The average increase of the unbroken twenty-eight day specimens over the ten-day specimens was 38.5 per cent.

Twenty-six per cent of the unbroken specimens were stronger at twenty-eight days than the regular twenty-eight day cylinders for this period. This may be due, the engineers point out, to a lack of uniformity in fabricating the two test pieces representing the day's run.

In summing up, the men who made the experiments declare that it is not probable that the ultimate strength of the concrete, once broken, ever will equal the strength of the same concrete had it been cured to final test without being fractured. It is evident, though, that there is a pronounced tendency for the concrete to reunite across the fractured area.

G. H. P. Lichthardt, chemical testing engineer for the California Highway Commission, explains the phenomenon as follows:

"The increase in strength in concrete subjected to a stress that will injure it is due to the added results of the complete chemical reactions which have taken place subsequent to the injury.

"One of the compounds formed by the hydration of cement is a kind of calcium hydrate which is water soluble to the extent of about fifteen hundredths per cent. Therefore, should concrete be placed in water, this hydrate will dissolve until a saturated solution is obtained.

"If the test piece be taken from the curing vat, cracked or caused to yield without disintegration, and then placed in water or kept moist, crystals will be deposited on the facets of the freshly-exposed material. This secondary deposit has the effect of sealing the cracks, but naturally will not have the strength of the original material.

"The same action will take place in concrete which is alternately wet and dried, as well as that which is immersed in the curing vat, but the healing will be of longer duration and the deposit weaker, as there is greater opportunity for carbonation taking place."

The engineers say that the discovery is of more academic than practical value. It is well to know, however, that minor cracks which may appear during the initial setting of concrete structures, particularly bridges, as well as in pavements, do not mean that a failure is imminent. A sealing process probably is going on; and the ultimate strength of the concrete in many cases is not seriously affected.

## Viner to Study Street Financing

Announcement is made by Charles M. Upham, director. Highway Research Board of the National Research Council, of the commencement of a new investigation on the Urban Highway Finance Problem. Jacob Viner, Professor of Government Finance at the University of Chicago, and a consulting expert on finance problems, has been selected to conduct this investigation. The objects of this study are: To determine the relation of city dwellers to the rural finance problem; to investigate the problems of city street finance including the financial problems of construction, maintenance and widening of city streets; and to study the financial aspects of city traffic control.

Professor Viner is a graduate of McGill and Harvard Universities and was formerly with the United States Tariff Commission. In addition to his duties at the University of Chicago, he is chairman of the Highway Finance Committee of the National Tax Associaton, which presented a comprehensive report at its 1924 meeting. He is also secretary of the Revenue and Taxation Committee of the Chicago City Club, and is a member of the Chicago Civic Committee on the Reform of the Illinois Tax System.

The report on this investigation will be presented at the fifth annual meeting of the Highway Research Board to be held in Washington, D. C., on December 3 and 4, 1925.

# Roof Tile Problems Being Solved

## The Manufacture of Concrete Roofing Tile Has Made Great Progress in Past Years — Kinds of Machines — Colors — Curing — Mix — Strength — Plant Costs — A Successful Plant Described

By HARVEY WHIPPLE

Any orthodox article about concrete roof tile should begin by casual reference to the use of tile for roof coverings since the reign of King Solomon. The very early tile were of burned, and not very well burned, clay. They were, of course, very rudely made, did not fit nicely on the roof and let in a good deal of weather when there was any weather to let in. The next point to be made is that concrete tile have been extensively used in France, Northern Germany and elsewhere in upper Europe for forty or more years. From there they came to America 25 or 30 years ago and have slowly, sometimes very slowly until recent years, got a place in popular opinion.

There have been a good many failures at concrete roof tile manufacture but there have been some very notable successes. The use of the product is increasing. Where a few have demonstrated that success can be achieved, it is then no longer impolite to point out some of the tender spots in the business. And since this is written largely for prospective manufacturers of roof tile, let's dispose of the rough places first. The manufacture of roof tile is a worthy concrete products line for the consideration of good business men who have an appreciation of the special problems involved. The fact that ships, Wilson Dams and laundry trays are made successfully of concrete is not proof positive that all concrete tile roofs made any-old-fashion, will shed all the rain that falls on them. It is also a fact that filters are made of concrete. This is not set down to be facetious but to give point to the fact that concrete is a variable. Sometimes it serves best when it is very dense (laundry trays for instance) and sometimes when it is very porous (for instance, cinder concrete building block).

Concrete roof tile must have a thin section to avoid undue weight. So far it has not been considered practical to make such small tile of a wet mix, as large tile are made for industrial uses. It is no simple matter to tamp concrete in a mold only half to three-eighths of an inch deep—that is, no such tamping pressure can be applied as in thick or deep sections of concrete for other purposes.

*French tile (Hawthorne) on roof of residence at 1024 Brumel Street, Evanston, Ill.*

Again a thin section of concrete dries out more readily and that involves special care in curing. Thus a unit of such delicate proportions as a roof tile must impose extra care in the making of the concrete all along the line—the choice of the materials, their manipulation, their curing. A small defect in a big bulky product becomes a large defect in a small product. The concrete must be of as uniformly high quality as the limitations of commercial manufacturing process will permit.

### Kinds of Machines

Roof tile machines are in general of two kinds, hand and power actuated.

A hand machine may be roughly described as a sturdy table framework providing support for a pallet. The pallet supports the concrete while it is soft and gives the

*Spanish tile on residence at 188 Church Road, Winnetka, Ill. Dean & Dean, architects*

*Hawthorne Spanish Colorblend tile on residence at Wilson Ave. and Chicago River, Chicago, Ill. A. L. Klewer, architect* roof tile its bottom shape. Hinged at the back of the table is a frame which tips down around the pallet and defines the edges of the tile. On the sides of this frame rides a loose trowel-bar, a template, which shapes the top surface of the tile, the finished weather surface. This bar, held at either end by the tile maker, is used with a motion which combines tamping, troweling, striking off. The mixed concrete is scooped out of a box or bin, usually placed behind the machine, in front of the operator. With a scoop he fills the frame on top of the pallet; tamps, strikes off and smooths the surface. Then he sprinkles on, frequently from a perforated dipper, a mixture of cement and mineral color, dry. Sometimes sand is mixed with the cement and color to give body to the top, on the theory of making the color more nearly integral with the body concrete itself. The first tamping and smoothing of the tile surface has brought up some surplus moisture which is taken up by the dry color mix. This is worked over with the trowel-bar until the surface is of a smooth uniform appearance. The hinged frame is then tipped back, the pallet bearing the fresh tile removed and set on a rack.

With automatic machines pallets are fed in at one end passing between guides, the concrete is deposited from a hopper and the loaded pallets pass under strikes, or tampers which shape the product to receive the color mix from a second hopper. On some machines this mix is fed dry as with the hand made tile and others apply it wet. This color mix is shaped and smoothed and the ribbon of concrete, lying on the chain of pallets is cut off automatically and carried away to the racks, either by hand or automatically by a conveyor.

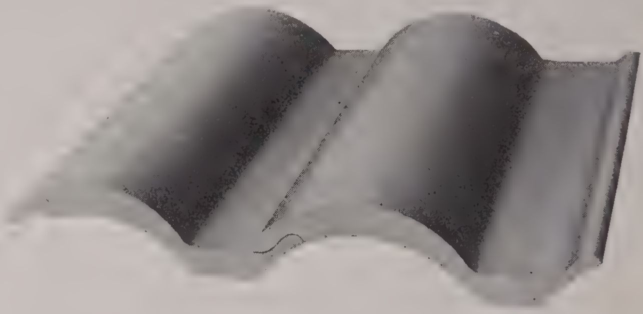
The foregoing is a very general description, because there are a number of machines on the market, both in the hand and power classes and each machine has its talking points. Each of the tiles produced—from the different machines—has features of design which are the special pride of the designer or of the manufacturer of the equipment. Since there are satisfactory roofs and good manufacturing enterprises to show for several different machines, and the several different designs of tile units in both the French and Spanish tile patterns, it is not proposed to undertake any judgment among them.

## Some Real Problems

The problems which have given the most trouble in the roof tile business, the problems which have raised the most questions from the producers of the tile, are problems which are more or less common to all of them.

*General view of interior of Hawthorne tile plant, with the conveyor that carries the tile to the racks*

*The exterior of the Hawthorne Roofing Tile Company plant, showing circular concrete bin for raw material storage*

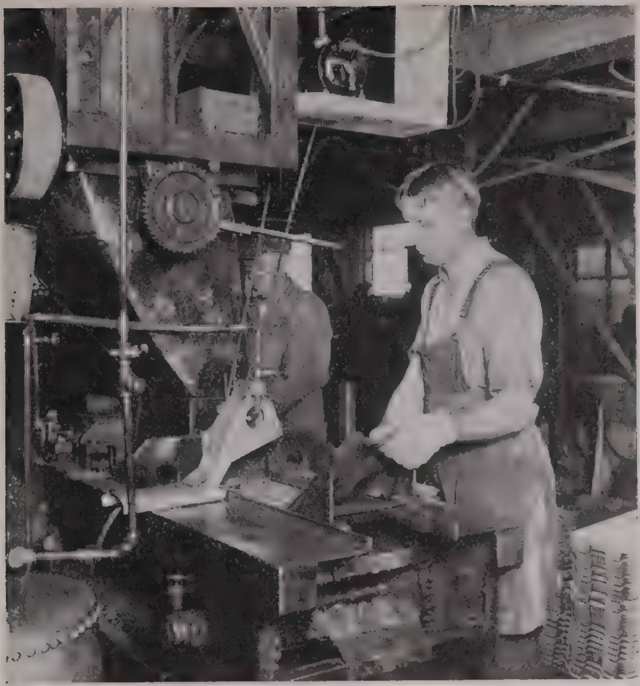


*Here is the type of Spanish tile turned out by the Hawthorne machine*

There have been problems of excessive breakage, of durability of the color on the surface, of curing, of selling and of that problem, common to the entire concrete industry, to the control of the quality of the mix—a standardized control, upon which the ultimate strength and quality of the product can safely depend.

In view of the importance of these general problems one looks for solidarity among the manufacturers of roof tile for their solution. They had a concrete roof tile association at one time. Later (1923) the American Concrete Institute sponsored a conference of the roof tile people with a view to the organization of a committee which should attack some of these common problems. A committee was organized, reorganized and organized again. It appears to have failed thus far through a lack of industrial solidarity engendered by the partisan proponents of various types of machinery. This, in spite of generally confessed need for a pool of their interests. At the conference in February, 1923, the color problem was outstanding.

It was then and is still an outstanding problem because it is in such plain sight on the house tops. It is the problem that has come oftenest between the buyer and the seller. The manufacturers of roof tile had no standards ready-made for them by which to buy their colors or to mix them. They could only experiment with this mix and with that; some were bad and some good. Individual manufacturers of tile have apparently solved the color problem and the leading one it now gives a written guarantee to his customers of the permanence of his color. Others have solved it to the extent of finding a source for their supplies of color which are dependable and arbitrary methods for use which give good results. Still the chemical and physical characteristics of color as



*The man in the foreground is feeding in the pallets, while the man to the rear sees that materials feed evenly and that a uniform coating of color goes on each tile*

a basis of standards upon which other supplies of material might safely be used are a closed book.

### New Colors Demanded

It was very natural that in beginning the manufacture of concrete roof tile, an effort should have been made to duplicate the reds which were common in the clay tile with which the public was to some extent familiar. Later came a demand for green; buffs, browns, grays and even blue have come later. Iron oxide for red and chromium oxide for green are accepted safe standards. Colors vary in quality, in coloring value—in fineness and in specific gravity. A poor color has to be used in a higher percentage with the cement for good color value than a color of quality, so the more expensive colors are sometimes the more economical. After ten or a dozen years it was apparent—manufacturers themselves frankly confessed it—that the tile on some roofs appeared to have faded. It took a very much shorter time for fading to become apparent in other work. The buyer demanded color permanence. Close observations have disclosed that not all the faded roofs are chargeable to fading of the color itself. Some of the loss of color has been due to attrition. The film of color on the surface of the tile has worn off under rain and frost and temperature change until the color that remains is greatly toned down by the appearance of the gray concrete beneath. Thus the tile manufacturer has two problems: to select the right color, one that is limeproof and otherwise chemically stable in a concrete mix and the other to bind that color in the surface of the product.

Manufacturers point out a tendency of the color to float to the top under excessive troweling—to separate from the cement, so that there is little or nothing to hold it in place. A remedy has been suggested in less troweling and in the selection of mineral colors having the same specific gravity as the cement. Other manufacturers put some sand with their cement-color mix in an effort to create a surface film having more body and one that can be made more intimately a part of the surface of the tile. Many recommend that the color and cement be ground together in a small mill to insure an intimate mix. The fine points of the color problem by which the manufacturer may be able to buy his color with confidence and mix it with some certainty of the result are not generally known.

### Steam Curing Unnecessary

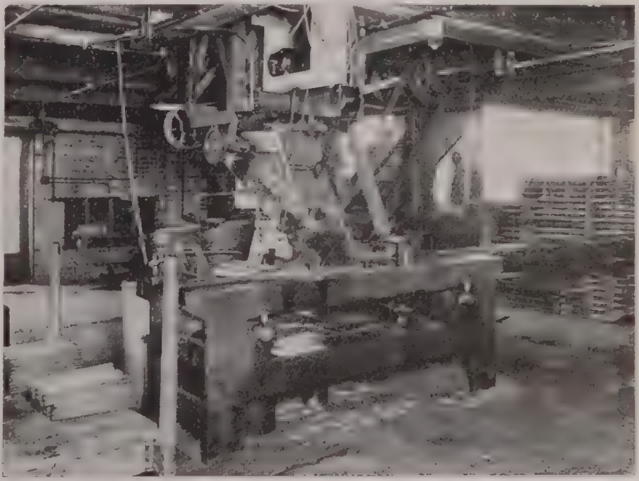
Steam curing of concrete roof tile is not general. There is a well established belief that the temperatures used satisfactorily in curing bulkier products—125 to 150 degrees—produce too rapid and unsatisfactory results; that roof tile must be hardened more slowly. It has been common therefore to stack the tile on the pallets set on racks in the work room, the racks being arranged in convenient short alleys at right angles to the line of hand machines, and to remove the tile from the pallets the next day after manufacture and put them in storage piles to be more or less regularly wet down. Such curing conditions admit of a good many variables.

One manufacturer set up curing rooms equipped with steam pipes and water pipes, the latter at the side overhead and the pipes perforated. Below these pipes several thicknesses of burlap curtains, kept wet constantly from the perforated water pipes, hung between the tile and the steam pipes. The cold water was depended on to keep the temperature down in summer and to prevent overheating when steam was turned on in winter. This producer aimed to keep the temperature between 45 and 55 degrees. This would give very slow hardening and necessitate large curing-space if the factory had a big output.

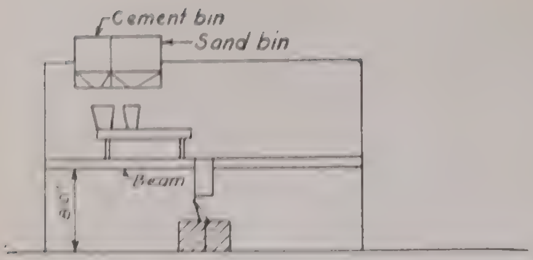
Curing conditions are generally believed to have a decided influence on the amount of efflorescence or bloom on the surface of the tile. One of the biggest and most successful manufacturers, in order to speed up the availability of the tile for market, has installed steam curing rooms. Tile are stacked on pallets on racks in the open shop the first day as before but when removed from the pallets the tile are put into the steam curing rooms. This treatment is said to have reduced the amount of efflorescence. As with the color problem, the curing problem is but partly solved and that in individual cases by cut and try methods rather than scientific investigation of the conditions which should be standardized for the best results.

### The Proper Mix

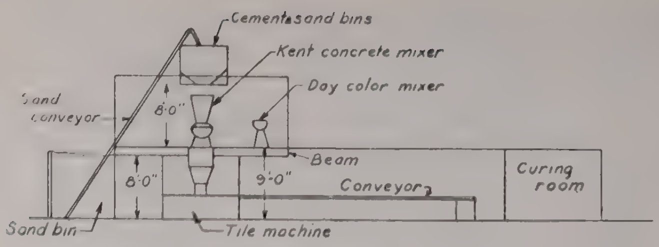
The last few years have shown a good deal of improvement in the general knowledge of the factors that govern the quality of concrete in general. Some of this advance is reflected in the concrete roof tile business. The



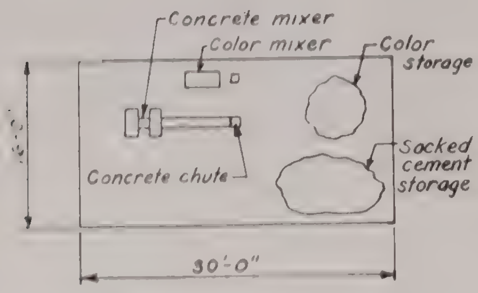
*The Hawthorne automatic tile machine, one of the two in the Hawthorn plant, with new tile passing to the conveyor*



CROSS SECTION



LONGITUDINAL SECTION



SECOND FLOOR PLAN

*Suggested plant layout and details for the operations of one automatic roof tile machine (Hawthorne)*

better quality product has reduced breakage and given a more weather resistive unit.

This mix is usually about one to three cement and aggregate passing a No. 6 screen, while some manufacturers use aggregate passing a No. 4 screen. Coarseness of the aggregate is held between narrow limits by the thin section of the product and the necessity for a smooth top finish, yet the same principles as to the importance of realtive coarseness still govern and give a stronger product with less cement.

The selling problem has yielded to the good business sense which is in control of a number of the better roof tile plants.

When concrete roof tile are properly made there is no question of the permanent service which they give. They supply no fuel for sparks from chimneys or brands from nearby fires. This is an important consideration when it is realized that about 20% of fires start on the roof. Inflammable roofs are more and more recognized as a public menace and cities are constantly being added to the list which do not permit such roofs to be put on. When the necessity imposed by building regulations, or an appreciation of the economy of permanence or of the enhanced value of buildings permanently and beautifully roofed has turned the mind of the builder from the cheap and inflammable roof coverings, he is already half sold on concrete tile. For when permanent roofs alone are considered, concrete is immediately available as cheap in first cost as well as economical over a term of years. It is available in a wide color range and the methods of putting in on the roof, in any locality where a standard practice has been developed, insure satisfaction.

Where color fading has been an issue, that issue has often been eliminated by variegated roofs. These are justly popular and while the mixtures of colors which are now available in several different roofing materials are frequently carried to extreme, blended colorings, laid in artistic random fashion, make beautiful roofs.

Concrete roof tile stand well as to weight and require no unusually heavy roof construction. The weight ranges usually from 750 to 850 lbs. per sq. (100 sq. ft.). Clay tile is heavier, from 900 to 1800 lbs.; slate, 680 to 2000 lbs.; asbestos-cement shingles, 300 to 600 lbs. Another advantage of concrete tile is trueness to form.

## Plant Costs.

In a survey of the roof tile manufacture as a business opportunity the Portland Cement Association compiled the following figures as representing investment and manufacturing costs in a very general way. Such figures must, of course, be corrected for each locality and set of conditions and the figures shown were intended to give merely a preliminary idea of the possibilities involved:

### Concrete Roofing Tile Manufacture Machinery Schedule

INVESTMENT REQUIRED TO PRODUCE 11 SQUARES PER 8-HOUR DAY

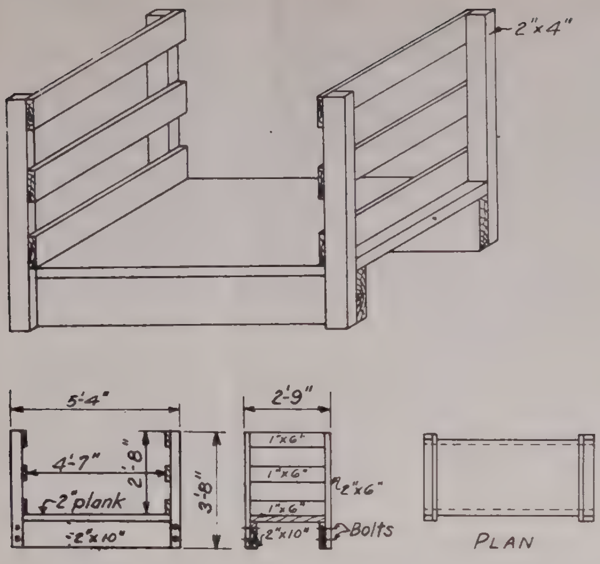
| | | |
|---|---|---|
| 4 hand machines | $3,000 | |
| 2,000 pallets | 2,000 | |
| Cars and racks | 1,000 | |
| Mixer | 300 | |
| Motor | 200 | |
| Shafting, belts, etc. | 50 | |
| Material Conveyor, screen, etc. | 250 | |
| Gravity Conveyors | 200 | |
| Tools | 200 | |
| Color Mixer | 100 | |
| Freight | 300 | |
| Installation and wiring | 500 | |
| Miscellaneous | 600 | |
| TOTAL Mechanical Equipment | | $ 8,700 |
| Building, including material bins and curing rooms | $5,500 | |
| Curing and heating equipment, including boiler and piping | 1,000 | |
| Contingent | 500 | |
| TOTAL Building Investment | | $ 7,000 |
| Total Plant Investment | | 15,700 |
| Additional Operating Capital | | 5,000 |
| Total Capital Investment | | $20,700 |

### Cost of Manufacturing

ELEVEN SQUARES ROOF TILE PER 8-HOUR DAY 250 OPERATING DAYS PER YEAR—MIX 1 TO 3

Color Red

| | | Cost per Days Run | Cost per Square |
|---|---|---|---|
| *Cement, 22 sacks at 65c | | $14.30 | $ 1.30 |
| *Aggregate, 2½ cu. yds. at $2 | | 5.00 | .46 |
| †Color, red oxide, 33 lbs. (3 lbs. per square) at 15c | | 4.95 | .45 |
| Direct labor—1 operator foreman at $7 | $ 7.00 | | |
| 3 operators at $5 | 15.00 | | |
| 2 helpers at $3.50 | 7.00 | | |
| 1 mixer man at $4 | 4.00 | | |
| Daily Labor | | $33.00 | $ 3.00 |
| Manufacturing lubricating oil (1½ gal.) | $ 0.55 | | |
| Expense (per day)—Liab. insurance 4% | 1.32 | | |
| Water | .25 | | |
| Fuel (curing and heating) | 1.00 | | |
| Power and light | .50 | | |
| Repairs to equipment | 1.25 | | |



DETAIL OF HAWTHORNE TRUCK BODIES

MATERIAL REQUIRED FOR 10 BODIES

| | |
|---|---|
| 2"x10" | 20 pieces 5'-4" long |
| 2" plank | 150 sq. ft. |
| 2"x4" | 40 pieces 3'-8" long |
| 1"x6" | 60 pieces 2'-9" long |

80-½" bolts 5" long with heads, nuts and 2 washers

| | | | |
|---|---|---|---|
| Breakage | 2.00 | | |
| Miscellaneous | 1.00 | | |
| General Expense | | $ 7.87 | $ 0.71 |

### Depreciation and Obsolescence

| | Yearly | | |
|---|---|---|---|
| Equipment, 20% of $8,700 | $1,740 | | |
| Buildings, 5% of $7,000 | 350 | | |
| Interest on investment, 7% of $20,700 | 1,450 | | |
| Taxes and insurance | 700 | | |
| Land rental, 6% on $5,000 | 300 | | |
| TOTAL OVERHEAD PER YEAR | 4,540 | | |
| Total overhead per operating day | | $18.16 | $ 1.65 |
| Total yard cost of 11 squares | | $83.28 | |
| Total yard cost per square | | 7.57 | 7.57 |

(Exclusive of delivery, selling expense, profit and laying.)

*Team delivery of material is assumed for these calculations.
†Green oxides cost three or four times as much as red oxides.

Where the demand warrants an output of 10 roofs and up per week, an automatic roofing tile machine will prove economical. Several satisfactory automatic machines are now on the market and in use. As to be expected, a considerable saving per square in manufacturing cost is obtained with quantity production. Costs on this basis will be approximately as follows:

### Concrete Roof Tile Manufacture Machinery Schedule

INVESTMENT REQUIRED TO PRODUCE 28 SQUARES PER 8-HOUR DAY

| | | |
|---|---|---|
| Automatic machine | $5,000 | |
| 5,000 pallets | 5,000 | |
| Cars and racks | 2,500 | |
| Mixer | 500 | |
| Motor | 400 | |
| Shafting, belts, etc. | 150 | |
| Material, conveyor, screen, etc. | 250 | |
| Gravity conveyors | 500 | |
| Color mixer | 100 | |
| Installation and wiring | 800 | |
| Tools | 300 | |
| Freight | 500 | |
| Miscellaneous | 1,000 | |
| TOTAL Mechanical Equipment | | $17,000 |
| Building, including material bins and curing rooms | $5,500 | |
| Curing and heating equipment, including boiler and piping | 1,500 | |
| Contingent | 1,000 | |
| TOTAL Building Investment | | $ 8,000 |
| Total plant investment | | 25,000 |
| Additional Operating Capital | | 10,000 |
| Total capital investment | | $35,000 |

### Cost of Manufacturing

TWENTY-EIGHT SQUARES ROOF TILE PER 8-HOUR DAY, 250 OPERATING DAYS PER YEAR—MIX 1 TO 3

Color, Red

| | | Cost per Days Run | Cost per Square |
|---|---|---|---|
| Cement, 56 sacks at 65c | | $36.40 | $ 1.30 |
| Aggregate, 6½ cu. yds. at $2 | | 12.40 | .45 |
| Color, 84 lbs. (3 lbs. per sq.) at 15c | | 12.60 | .45 |
| Direct Labor—1 operator at $5 | $ 5.00 | | |
| 2 off bearers at $3.50 | 7.00 | | |
| 1 helper at $3.50 | 3.50 | | |
| 3 yard men at $3.50 | 10.50 | | |
| 1 mixer man at $4 | 4.00 | | |
| 1 foreman at $10 | 10.00 | | |
| | | $40.00 | $ 1.43 |

### Daily Labor

| | | | |
|---|---|---|---|
| Manufacturing lubricating oil (4 gal.) | $ 1.40 | | |
| Expense (per day) liab. insurance 4% | 1.60 | | |
| Water | .40 | | |
| Fuel (curing and heating) | 1.50 | | |
| Power and light | 1.25 | | |
| Repairs to equipment | 2.00 | | |
| Breakage | 5.00 | | |
| Miscellaneous | 3.00 | | |
| General Expense | | $16.15 | $ 0.58 |

### DEPRECIATION AND OBSOLESCENCE

| | Yearly | | |
|---|---|---|---|
| Equipment, 20% of $17,000 | $3,400 | | |
| Buildings, 5% of $8,000 | 400 | | |
| Interest on investment, 7% of $35,000 | 2,450 | | |
| Taxes and insurance, 6% of $25,000 | 1,500 | | |
| Land rental, 6% of $8,000 | 480 | | |
| Total Overhead Per Year | $8,230 | | |
| Total overhead per operating day | | $32.92 | $ 1.17 |
| Total yard cost of 28 squares | | 150.47 | |
| Total yard cost per square | | 5.38 | 5.38 |

(Exclusive of delivery, selling expense, profit and laying.)

These figures would apply in many efficient plants, but would be slightly lowered under the most favorable conditions.

### A Successful Plant

The accompanying illustrations give a general idea of one of the largest and most successful concrete roof tile plants, that of the Hawthorne Roof Tile Co., Leslie H. Allen, general manager, Cicero, Illinois, supplying the Chicago market. The pictures also convey an idea of the roofs made with the product and the class of buildings on which they are being used. The plant operates two automatic machines and the output for this year will be about 20,000 squares (150 tiles to the square). In the early part of the year both the machines were not operated full time. With a production of 45 squares per day per machine it is necessary to keep four men at work making specials, a smaller, but very necessary part of every roof, along with the machine-made field tile.

The Hawthorne plant was established by Carl A. Carlson, builder, with hand machines but as the market expanded he became impatient with hand production and in collaboration with C. O. Brandell, engineer, produced the automatic machine whose operation was described in this magazine at the time. With it tile have been produced at the plant for the last four years, and a number of similar plants established in other large centers where the market warrants big production.

The concrete and the wet color mix are prepared on an upper level of the plant and fed through chutes to the machine. Pallets are fed into the machine at one end; are automatically sprayed with oil and pass under the hopper from which the concrete is deposited, then under a tamping mechanism, next under a trowel at which point the wet color mix is applied, then a final trowel movement and the tile moved out onto the conveyor extending into the plant between alleys of stacks on which the offbearers place the fresh units. Next day tile are removed from the pallets and stacked up edgeways on Special lift truck racks for removal to curing rooms where the hardening period is shortened. The following day the tile go to the stacks in the yard. A special brushed texture is being experimented with at this time. The trick is easy. Two men with whisk brooms, standing along the conveyor near the machine, stroke the surface of the tile with the broom, using a wavy motion. The result is interesting and novel. This new tile is already in demand.

It is proposed to maintain close to full production on both automatic machines this winter—about 500 squares per week, so that a big stock will be available in the spring, and to enlarge the plant next year for a third machine and a fourth in 1927, thus looking forward to a 40,000 square market by 1928.

Tests of Hawthorne tile were reported by the Structural Materials Research Laboratory, in July, 1924, as follows:

Tests of six concrete-roofing tile and three clay-roofing tile. The tile were first tested for absorption; after the absorption test they were dried to a constant weight and tested for leakage.

No information was furnished concerning the mix, proportions, methods of manufacture, etc.

*Absorption tests* of the tile were made in water at room temperature. They were dried to a constant weight at a temperature of about 110° C. and immersed in water for 24 hours. The gain in weight, calculated as percentage of the dry weight, is the absorption.

Leakage test was made by allowing a stream of water to flow over the top surface of the unlined tile until moisture appeared on the under surface.

Tests were completed July 2, 1924.

| Lot | Kind of Tile | Type of Tile | Dry Weight lb. | Absorption-percent by Weight (after 24 hr.) | Leakage Test (Time When Moisture appeared on under surface) |
|---|---|---|---|---|---|
| 7437 | Concrete | French | 5.7 | 6.3 | 7 hr. |
| | Concrete | French | 5.7 | 9.7 | 5 hr. |
| | Concrete | French | 5.6 | 8.4 | 5 hr. |
| | | | | Av. 8.1 | |
| 7438 | Concrete | Spanish | 5.6 | 8.5 | 1 hr. |
| | | Spanish | 5.6 | 8.5 | 4 hr. |
| | | | | Av. 8.5 | |
| 7439 | Clay | Spanish | 4.5 | 11.5 | 2 hr. |
| | | Spanish | 5.0 | 8.7 | 2 hr. |
| | | Spanish-Mission* | 5.6 | 18.5 | None at 10 hr. |
| | | | | Av. 12.9 | |

*Glazed tile.

## Denies That Building Shortage Has Been Met

Fears that the United States is being over-built are premature and not founded on fact is the conclusion reached in a recent report by the Indiana Limestone Quarrymen's Association. The report states that in only a very few cities is there a surplus of buildings. The gigantic shortage caused during and after the war has not been overcome and in the opinion of the officials of the Association there is no danger of general over-building for the next two years.

## Making California's Best Pavement

By MICHAEL J. PHILLIPS

What is regarded by the State Highway Commission as one of the best concrete paving jobs in California has recently been completed. Several improvements in construction methods were incorporated in doing the job.

The pavement, seven and one-tenth miles long, unites the cities of Redlands and Beaumont. It closes one of the few remaining gaps between San Bernardino and the Imperial Valley. Except for a few slight line and grade corrections the subgrade followed closely the surface of the grade built in 1920.

The concrete is 20 ft. wide and 6 in. thick. An innovation is the thickening of the surface from 6 to 9 in. on the outer three feet on each side. The pavement was struck off and tamped with a Lakewood tamping machine running on three-inch by ten-inch timber headers, and finished with a longitudinal float and belt. Careful supervision of the job was maintained and it is believed that the Vialog test will show an exceedingly smooth finish.

A center joint was placed the entire length of the contract. The joint consists of 1-in. by 5-in. by 10-ft. pine boards toe-nailed to the subgrade by 40-penny spikes and held together at the abutting ends by strips of tin nailed to the upper edges.

Careful control was maintained in proportioning of materials. The batch truck system was used, all batches being proportioned at the plant on the railroad siding at Beaumont. The coarse aggregate was measured in two sizes to obtain the proper grading.

Culverts were extended where necessary. Curbs were built through cuts, and gutters leading to slope drains were provided where necessary to avoid erosion of fills. Basich Brothers of Los Angeles were the contractors and R. L. Young was resident engineer.

## Wrenches Are Long Enough

By W. F. SCHAPHORST, M. E.

Newark, N. J.

Several times I have seen the "kink" in print which shows how to make a wrench longer by "slipping a gas pipe over." It is a very simple procedure and it may look and sound good to some, but I don't believe in making a wrench longer in order to put nuts on tighter.

As you doubtless have observed, wrenches for small nuts are invariably short; for medium nuts, medium in length; and for large nuts, they are long. The manufacturers therefore seem to have some "system" in making wrench lengths, and they have. The pitch of the thread is considered, the cross-sectional area of the bolt at the bottom of the thread is considered, and the strength of the man who does the tightening is also considered.

To make a wrench "twice as long" you therefore increase the tension of the bolts to twice the amount, the force of pull on the wrench being the same. By increasing wrench lengths, I have frequently actually "stretched" bolts until they broke in two, or stopped turning as soon as I felt the bolt begin to stretch. This is poor practice, and I do not do it any more. I do not increase the wrench's length any more because I realize that the elastic limit of a bolt should never be reached.

If you feel like making a wrench longer for "unscrewing" a nut—all right. But don't make it longer for tightening.

## Effect of Alkalis Upon Drain Tile

The best quality of cement mortar drain tile may disintegrate when exposed to severe alkali attacks, according to field inspections covering a period of ten years, conducted by the Bureau of Standards of the Department of Commerce. In fact, the Bureau recommends that installations of this kind in soils containing more than 0.1 per cent of salts of the sulphate type should be preceded by an examination of the surrounding conditions.

These conclusions are based on inspections of experimental drain tile and concrete blocks installed at eight localities in the alkali-bearing soils of the west. The work was started in 1913, in cooperation with other interested branches of the government, and inspections were made in 1916, 1919, and 1923. Since the results of all inspections show that the quality most needed to resist exposure to alkali water is impermeability, the Bureau is now studying methods for decreasing the permeability of concrete, including the use of alkali-resisting materials.

Some progress has already been made, and asphalt coated and sulphur impregnated tile have been prepared in the laboratory and specimens of each kind installed under severe field conditions at Montrose, Colorado.

## Builders Make Unusual Test

What is said to be one of the most unusual tests ever given reinforced concrete was recently made in connection with the plans for the Reed Hotel, a fifteen story structure to be built at Ogden, Utah. Engineers, contractors, building material men and scores of others displayed considerable interest in the experiment which was made by the architects, Leslie S. Hodgson and Myrl A. McClenahan at the request of the management of the hotel company. Before the plans, which call for a span of 33 ft. 9 in. between supports on one side, were finally approved, the president of the hotel company wished to be assured of the absolute safety of the proposed building, questioning the strength of a concrete span of this length. In order to make a convincing test a concrete span and cantilever was built, at considerable expense, in exact duplicate of the proposed construction and loaded with bags of sand. The experiment was conducted as follows:

On two 6-in. x 14-in. reinforced concrete joists was built a slab 2½ in. thick and 54 in. wide. The span of the joists was 33 ft. 9 in. and a cantilever 6 ft. 3 in. long extended over the support at one end, making the total length of the slab 40 ft. 10 in. The slab area, exclusive of wall bearing at the cantilever end was 180 sq. ft. The mix used was 1 cement—2.3 fine aggregate (100 to No. 4 sieve size)—4.1 coarse aggregate (No. 4 to 1½-in. sieve size). In the foundation and columns, 14 sacks, and in the joists and short beams 26 sacks of Beehive cement were used.

*Completion of concrete test made for Reed Hotel at Ogden, Utah. The structure tested is an exact duplicate of one side support in the hotel under construction*

Loading started on the 29th day after the slab concrete was deposited, the loading units being cement sacks filled with sand, the average unit weight being 108 lbs. The designed load on the slab was 200 lbs. per sq. ft. Eight increments of sand were loaded on the slab and the deflection measured at the center and at the cantilever end of the slab after each increment.

At the end of the test, the load on the span of 33 ft. 9 in. was 78,750 lbs. and on the cantilever, 6 ft. 3 in., 22,500 lbs., making the total load on the slab 101,250 lbs. The total per square foot, including 70 lbs. dead load, was 500 lbs., or two and one half times the figured load.

The deflection reading, taken at the center of the slab one hour after the final loading was 25/32 in., at the end of 15 hours it was 31/32 in. The change of elevation of the cantilever after one hour was ¼ in. up, and after 15 hours it was 9/32 in. up.

Many engineers and building experts from the surrounding terrritory were attracted to Ogden to view the test. The hotel management, for whom in the interests of safety the test was made, was thoroughly satisfied with the result and construction of the new hotel will follow the original plans.

## Harris Goes to Eberling Machines Sales

Wallace R. Harris has resigned his position with the International Trade Press, Inc., Chicago, as managing editor of *Highway Engineer and Contractor* and of *Concrete Products*, papers covering industries in which Mr. Harris had experience as engineer and contractor. He assumes the position of sales manager for the Eberling Machines Sales Co., Cleveland, makers of modern equipment for the manufacture of concrete building units. Mr. Harris will have an office at 1248 Peoples Gas Building, Chicago.

He was the first president of the Concrete Products Association and retired from this position after five years' service. His work with the International Trade Press, Inc., covered six years and seven months as of Oct. 31, 1925. Mr. Harris is a member of the following organizations: Engineering Institute of Canada, Western Society of Engineers, Illinois Society of Engineers, American Association of Engineers (second vice-president), Society of American Military Engineers, American Concrete Institute, Engineers' and Architects' Club of Louisville, Ky., American Road Builders' Association, Citizens' Good Roads Association, and is an associate member of the National Fire Protection Association. Mr. Harris has also served as director of two builders' associations, one in Louisville, Ky., the other in Regina, Saskatchewan. His work as an engineer and contractor has embraced several fields of engineering, including civil, electrical, hydraulic, mining and architectural work. Immediately prior to joining the staff of the International Trade Press, Mr. Harris was engineer of the Cement Products Bureau, Portland Cement Association, Chicago, and accepted that position after more than seven years' work in the prairie provinces of Canada embracing general engineering and construction, manufacture of Lock Joint reinforced concrete pipe for sewers and aqueducts, operation of a large gravel pit, and consultant on engineering problems for municipalities and construction companies. Mr. Harris had early in his business life experience in machine shop practice, and later in railroad construction, sewer work, underground conduit work, tunnels, the design and installation of power plants and buildings and the manufacture and use of concrete products.

## Hunt Co. Opens Birmingham Office

Robert W. Hunt Company, engineers, announce the opening of a branch office and cement laboratory, at Room 420 Alabama Power Company Building, Birmingham, Ala. T. C. Peace will be the resident manager.

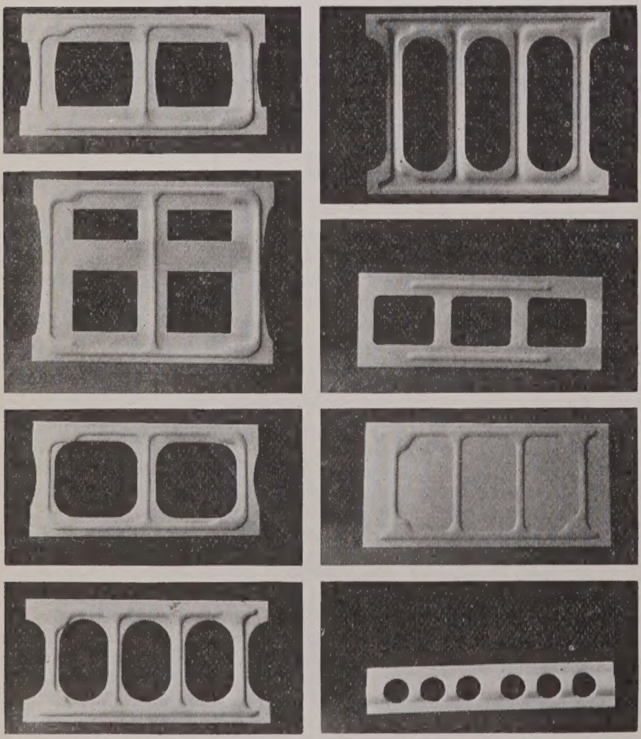
# New Steel Pallets Worth Attention

## The New Standardized Steel Pallet for Concrete Building Units Is a Forward Step in Economy, Efficiency and Standardization. It Is Now Being Used by Many Manufacturers

The Commercial pressed steel pallet is novel and of particular importance in the concrete products field as it is a decided step towards the standardization of concrete building units. This alone should appeal to the products manufacturer regardless of the other advantages such as strength, stiffness, light weight, small space required for storing, ease in handling, and uniformity of size.

As shown in the accompanying illustration a pallet is made for each type of concrete building unit and a design has been worked out by the manufacturers, the Commercial Shearing and Stamping Company, Youngstown, Ohio, which provides ribs along the long edges of the pallet as well as transverse ribs between the core openings, connecting with the longitudinal ribs. Pockets are provided by widening the longitudinal ribs to take care of the stripper pins. This design when executed in heavy steel plates, formed cold in extremely heavy embossing presses, produces a pallet which is exceptionally stiff and light in weight. The ribs being pressed in cold give the steel in the pallet a strength equivalent to metal that is considerably heavier. The weight of the steel pallet is approximately one-half as much as that of a similar cast iron pallet.

Another apparent advantage cited for the steel pallet is its resistance to rough handling. It will not break under such conditions as when run over by a truck and although it would undoubtedly be bent under the weight it can be put back into service by straightening with a hammer. In removing the steel pallet from the back of the block, there is no danger of breaking it with a tap of a hammer even in cold weather.



*Typical pressed steel pallets as developed by the Commercial Shearing and Stamping Company for concrete building units. The ribs along the long edges of the pallets and the connecting transverse ribs, which give the pallets additional stiffness, are plainly visible*

As space is an important factor in most block plants, the fact that the pressed steel pallets can be stacked about four to the inch in height, consuming about one-third of the space required for the same number of iron pallets, is another advantage. A high degree of accuracy is obtained in the production of pressed steel pallets, with the result that they are flatter than pallets made of cast iron. One man can easily carry twenty steel pallets, ten in each hand.

The credit for the development of the pressed steel pallet is due to the Commercial Shearing and Stamping Company. Having evolved a satisfactory design that company approached the large block machinery manufacturers with a view to surveying the size of the possible field for the pressed steel product. Although the machinery manufacturers looked upon the idea of the steel pallet with favor, it was found that there was practically no interchangeability between machines of the various manufacturers even though they were supposed to produce the same type of block with the same core openings.

The machinery manufacturers having signified their willingness to adopt a standard set of designs, it is obviously a big advantage to the concrete products industry, as all three-core machines put out since the fixing of the standard will accommodate the same pallet.

The pressed steel pallets are supplied by the machinery manufacturers themselves, as initial equipment with their machines, whereas in most cases cast iron pallets had previously been purchased by the block maker largely from local foundries and the wood pallets were made up at the local lumber yard. A large stock of pallets is maintained by the manufacturers in Youngstown, as a service to the trade in general and master pallets have been distributed to the machinery manufacturers for use as jigs in fitting the cores, thereby insuring that the Commercial pallets will fit the machines.

In view of the general trend toward standardization in all fields, the adoption of the standardized steel pallet by the block machinery manufacturers is an important step forward.

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## Deposit Required on Cuban Jobs

The Secretary of Public Works has issued an order to the effect that contractors for work under the Department of Public Works shall deposit a sum of money as guaranty of good faith before the contract shall become effective. The amount of the sum will be fixed at the discretion of the Department and, of course, will vary according to the sum involved in the contract, according to Commercial Attache Carlton, Jackson, Habana.

# Wanted—A Better Clamshell

### By PETER CROWLEY

There was a time, not many years ago, when clamshell buckets were rarely used on jobs of excavation. Folks at that time had not discovered the clamshell's worth in handling loose material, such as sand, gravel, crushed stone and coal. The idea was almost universal that nothing would ever be developed to take the place of the steam shovel in moving these more or less fluid substances. I'm not condemning the steam shovel, understand. There is a lot of work done by the steam shovel that could not be done by the clamshell, such as digging shale-flake rock and hard clay. Nor am I overly enthusiastic about the clamshell bucket, for I know very well that the development of this device has been sadly neglected in the past, so that the clamshells we have been using have not been the perfect instruments they would have been had more interest been taken in improving them. Since its earliest use, the clamshell has, until recently, retained the same old mechanical construction it had originally. There has always been a counterweight, four side-arms, a center shaft, a head-block, and so forth, with enough cable to close the bucket without putting too much stress on the closing line.

We must not overlook the fact that the only digging force a clamshell bucket has, is the difference between the weight of the bucket and the stress on the closing line. For example; if your bucket weighs 2800 pounds, and it takes a stress of 1800 pounds in the closing line to close this bucket, then you have only 1000 pounds of digging force left. But if you have a bucket that will close, while digging, with a stress of only 500 pounds in the closing line, then your lip pressure will be increased 1300 pounds. Of course, you must take into consideration the different kinds of material to be handled; some being much harder than others and requiring a greater stress on the closing line. Also, as the bucket closes, the material becomes compacted between the scoops, and the stress in the closing line increases until it is sufficient to lift the bucket out of the material it is digging.

I have noticed in many cases, where the stress in the closing line was very great, that the bucket was lifted out of the material without having had a chance to close. It is often necessary to reduce the length of the cable, or, rather, to cut down the reeving parts on the bucket, in order to enable the operator to get more closing speed. But in such cases you simply increase the stress on the closing line, with the result that you have less pressure on the digging edges of the bucket and do not get the digging efficiency you should have. Invariably, when the bucket is entirely open, the sheaves are as low, or lower, as any part of the bucket, and consequently, naturally come into contact with the material handled. The sand, or whatever the material may be, then works into the bearings, sticks to the cable, and is carried through the working mechanism of the clamshell, cutting out the bushings and shortening the life of both the clamshell and the cable.

I have often wondered why there was not more study made along these lines—study that would result in the manufacture of a bucket in which the weaknesses I have mentioned would be avoided. In my investigations of clamshell buckets I have noticed where many improvements could be made. I cannot help but think that some good mechanical engineer might find a way to improve the present style of bucket through the medium of a toggle action, or shortening-up leverage action, on the digging force, thus giving a sufficient digging force independently of the closing cable's influence. By this means the closing and opening speed, which is very essential in the efficient working of a clamshell, might be adjusted to what it should be without affecting the digging force of the bucket.

The clamshell bucket has many advantages over other excavating machines in the handling of certain kinds of material, and also as a digging device in places where the ground formation is suitable for its use. For the unloading of open cars, digging deeply without recasting, for mounting on cableways, on traveling cranes, on overhead cranes, and so forth, the clamshell is the most adaptable excavating machine we have. The use of clamshell buckets is on the increase, and no one knows where it will stop. It all depends on the improvements in the design of clamshell buckets which the future may bring forth.

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# Building Trades Employers to Meet

A national conference of contractors will be held in Chicago, at the Congress Hotel, on Tuesday, November 17, upon the call of the National Association of Building Trades Employers. It is reported that local associations in many large cities will be well represented.

The purpose of this meeting is to "discuss a number of mutual problems" so that organizations in each city "may be properly informed on the opinions and attitudes of the others regarding vital questions, in the hope that the interchange of ideas and information will better fit each city to handle its own negotiations."

Among the questions that will be discussed at the conference, according to the prospectus, will be wage rates for 1926 in the building trades, availability of labor and results of the apprentice training movement, the five day week in the building trades, and the business outlook for next year.

All contractors interested in these topics are invited to attend.

# We Need a Few Back Copies

## Can you help us out?

Our supply of several recent issues of CONCRETE is entirely exhausted, and we need a few copies of them, both for our files and to help out readers who want material contained in those issues.

Here are the ones we need:

April, 1925—Regular Edition
April, 1925—Cement Mill Edition
June, 1925—Cement Mill Edition
July, 1925—Cement Mill Edition

We'll be glad to pay a fair price for any of these that you can spare from your files. And you'll be doing us a favor that we'll be glad to return when we get the chance.

Concrete Publishing Co.
139 N. Clark St.
Chicago

## Trade Publications

*"Code of Ethical Practice,"* a booklet recently published by the Associated General Contractors of America, is a booklet that expresses ideals of business conduct that are well worth the consideration of every contractor. This code of ethics is the result of an investigation carried on by a committee appointed by the A. G. C. and is that adopted by the association. The booklet, beside the code of ethics, contains the report of the committee that presented the code at the annual meeting last winter. The code is essentially a practical application of the "Golden Rule" to the contracting profession.

*"Motor Roads in Latin America,"* by Frank B. Curran, of the Transportation Division, Department of Commerce.

This report, which has just been made public, discloses that in all Latin America, which includes South America, Central America, Mexico, and part of the West Indies, there is a grand total of only 70,428 kilometers (43,762 miles) of road passable for automobiles, or about one and one-half per cent of the estimated 2,941,294 miles of such roads in the United States. Of this 70,428 kilometers, it is further pointed out, only 8,868 are really good according to the American standard.

The advent of motor cars in greater numbers and the potentialities of motor transport in the development of the economic resources of the different states has, however, within recent years brought about a widespread popular agitation for more and better highways. Touring clubs, transportation companies, and business organizations have been vigorously championing the better roads movement and the enthusiastic support which all the Latin American republics are giving to the Pan American Congress on Highways, to be held in Buenos Aires, is taken as a significant indication of this awakened public interest.

Aware of these new developments and prompted by a desire to furnish American business men with a full and timely appraisal of facts, the Department of Commerce undertook a study of the Latin American highway situation. Surveys were requested from Trade Commissioners and consular officers in more than twenty Latin American countries. A composite summary of these officers' findings, carefully edited and collated, are found in this report.

Containing 166 pages, exclusive of maps and illustrations, it gives a comprehensive survey of present highway systems in the various countries, outlines building programs and summarizes the various measures, official and private, undertaken to stimulate highway construction. The characteristic administrative features and road building methods employed in the different republics are discussed, and information on the markets for the sale of American supplies and equipment is included.

Copies can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from any of the branch offices of the Department of Commerce.

*Duntile Builds Better Buildings Cheaper*, published by the W. E. Dun Mfg. Co., Holland, Michigan, is an attractively printed booklet describing the virtues of Duntile construction. The several types of hollow Duntile wall are illustrated, and examples of this sort of construction are given. The booklet tells what the material is and what it does in a manner that is interesting. This illustrated booklet may be obtained upon application to the manufacturers.

"Link-Belt, 1875-1925" is the title of an unusual booklet recently issued by the Link-Belt Company, Chicago, in commemoration of their fiftieth anniversary. Mechanically, the booklet is unusually good, and an example of fine printing. The subject matter is interesting, historically, as it compares the growth of the concern with the growth of industry during the same period. The early beginnings of the company, which has grown from a patent secured by William Dana Ewart in 1874, for a harvester drive chain to its present state, are described, the individuals responsible for its success are named, and its history traced down to the present day. An idea is given of the great industries using Link-Belt equipment today, and a few of the machines are illustrated by sketches. Copies of this interesting booklet may be secured upon application to that company.

How several companies establish specifications for every job in their organizations is described in *"The Job Blue Print"*—Personnel Leaflet No. 5, just published by the Policyholders' Service Bureau of the Metropolitan Life Insurance Company. These specifications cover titles, duties, working conditions, qualifications necessary and lines of promotion.

Such job blue prints or specifications assist the employment manager to select applicants, furnish a basis for rates of pay, establish definite lines of promotion, help to measure the efficiency of each employee and facilitate improvements of operations and processes.

Any executive may obtain a copy of the leaflet, without obligation, by writing direct to the Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York City.

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## *Organizations*

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit. Convention, Feb. 23-26, 1926, Hotel Sherman, Chicago, Ill.

American Concrete Pipe Association; M. W. Loving, Secretary, 111 West Washington St., Chicago. Convention, Feb. 22-23, 1926, Hotel Sherman, Chicago, Ill.

American Construction Council; Dwight L. Hoopingarner, Executive, New York City. Fall meeting, Chicago, Nov. 18-21, 1925, Congress Hotel.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 West Thirty-ninth St., New York City. Annual meeting, for members only, December 10, 1925.

American Road Builders' Association; Wm. H. Connell, President, Miss E. A. Birchland, Secretary, 29 W. 39th St., New York City. Annual convention and Good Roads Show, Chicago, Jan. 11-15, 1926. Exhibits.

Associated General Contractors of America; D. H. Sawyer Secretary, 1038 Munsey Bldg., Washington, D. C. Next convention January, 1926, Portland, Oregon.

Associated Metal Lath Manufacturers; 123 West Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference; Frank Burton, President, J. F. Downey, City Hall, Cambridge, Mass., Secretary.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, 160 North La Salle St., Chicago. Annual meeting, March, 1926, Atlantic City, N. J. Date not selected. No exhibits.

Concrete Products Association; W. H. Carey, President, Bert Carey, Secretary, 111 W. Washington St., Chicago, Ill. Next convention, Jan. 27, 28, 29, 1926, Hotel Cleveland, Cleveland, Ohio.

Mid-West Concrete Products Association; D. R. Donlen, Secretary-Treasurer, 4340 Marcy St., Omaha, Neb.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

National Association of Building Trades Employers; A. E. Coleman, President, 37th St. & Stewart Ave., Chicago. A. W. Dickson, Executive Secretary, 214 Electric Bldg., Cleveland, Ohio. National conference, Nov. 17, 1925.

National Association of Builders' Exchanges; William F. Chew, Baltimore, President; Earl F. Stokes, Secretary, 15 East Fayette St., Baltimore, Md.

National Crushed Stone Association; A. P. Sandles, Secretary, 405 Hartman Bldg., Columbus, Ohio.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East Twenty-second St., New York City.

National Sand and Gravel Association; T. R. Barrows, 903 Munsey Bldg., Washington, D. C., Secretary.

The National Lime Association; Burton A. Ford, Secretary, 918 G. Street, N. W., Washington, D. C.

Portland Cement Association; William M. Kinney, General Manager, 111 West Washington St., Chicago.

Wisconsin Concrete Products Association; D. R. Collins, Secretary-Treasurer, 425 E. Water Street, Milwaukee.